EDITORIAL

ON the eve of my departure for the USA from England, quite a few impressions come to mind, mostly about Television.

At the moment I have a feeling of having beaten the gun as it were, of having stolen a march on my fellow countrymen who have yet to experience the first impact of the TV screen.

I have sat goggle-eyed over Test matches, Eurovision, American Westerns and Shirley Abicaire until the thing has become pretty much routine.

But good or bad, the programs have a growing fascination, no matter how soon one learns to ke them for granted.

Which is the first point—there is no doubt about TV's iversal appeal. Nothing else devised by man can com- re with it—no other social factor is in the same class hen it comes to entertainment or the influencing of thought.

It combines the techniques of both radio and newsreel, it its presence in your own home, and at the intimacy of ur fireside, is something which can't be matched by either.

Europe may be a long way behind England with its TV, it it is only a matter of time before European countries ve audiences of millions instead of thousands.

Before long, I feel sure Russia will make an appearance the Eurovision network—an event of major importance. nd it's only a matter of time before the USA breaks rough on TV. After that will come the link to the East, d finally to Australia.

You have to see some of these big Eurovision tie-ups understand just what a profound effect they can have national understanding.

The second impression I think is important in that TV largely what you make it.

We have heard many discussions as to whether TV is a ood or bad thing. I think it's time we all abandoned is kind of talk. TV in itself has no good or bad qualities, ny more than fire has, or the picture theatre.

It all depends on the hands which use it.

So far I haven't seen any evidence of a baleful influence. have seen plenty of poor programs, or just indifferent nes. But I've not yet seen anything which could seriously fend the taste of a grown-up or mislead the mind of a ild. I have seen merely grateful applause for the good, and inted condemnation of the bad.

I'm not at all apprehensive about TV in Australia. I ink all concerned are aware of eir problems and will do their est to meet them. I'm sure they ould ask no more than to be dged by results.

John Moyle

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RADIO
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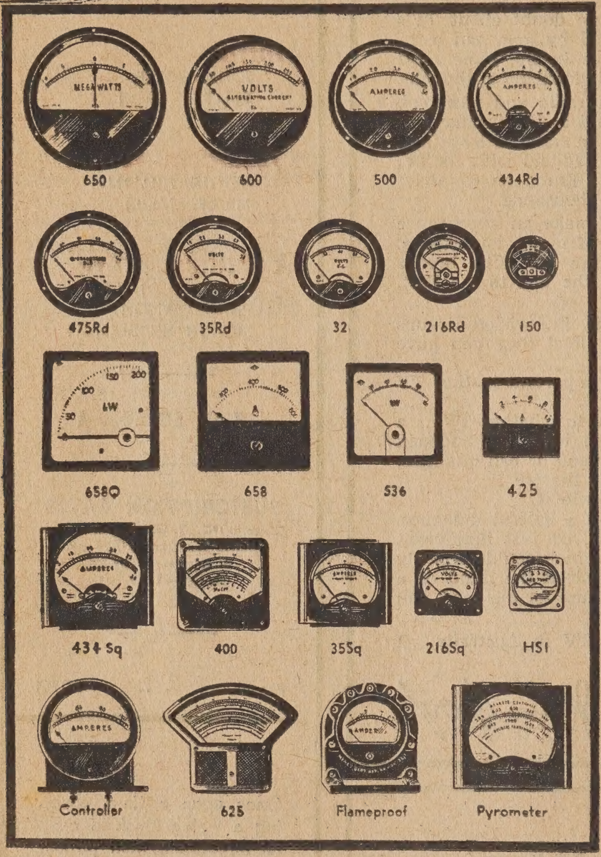
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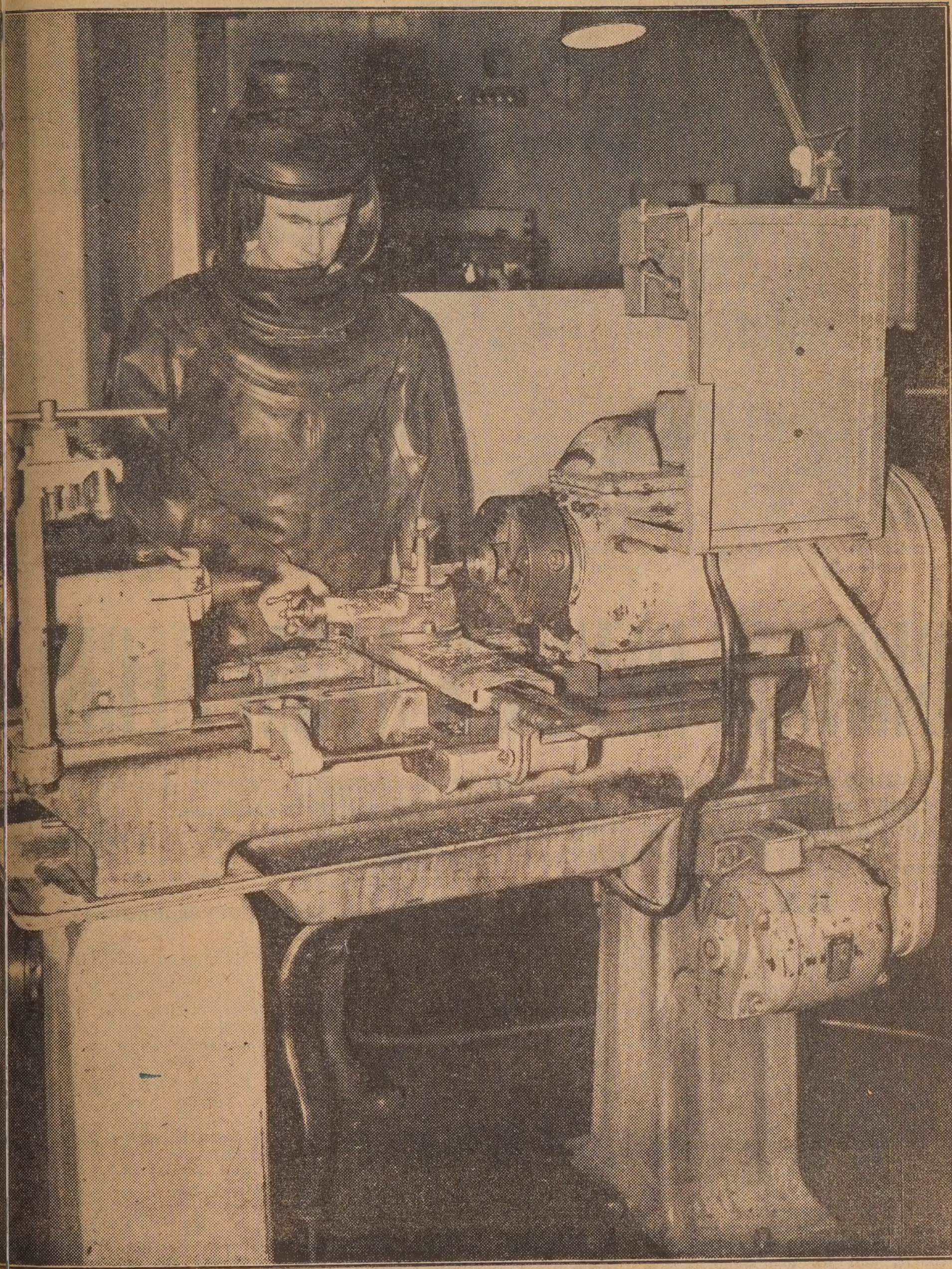
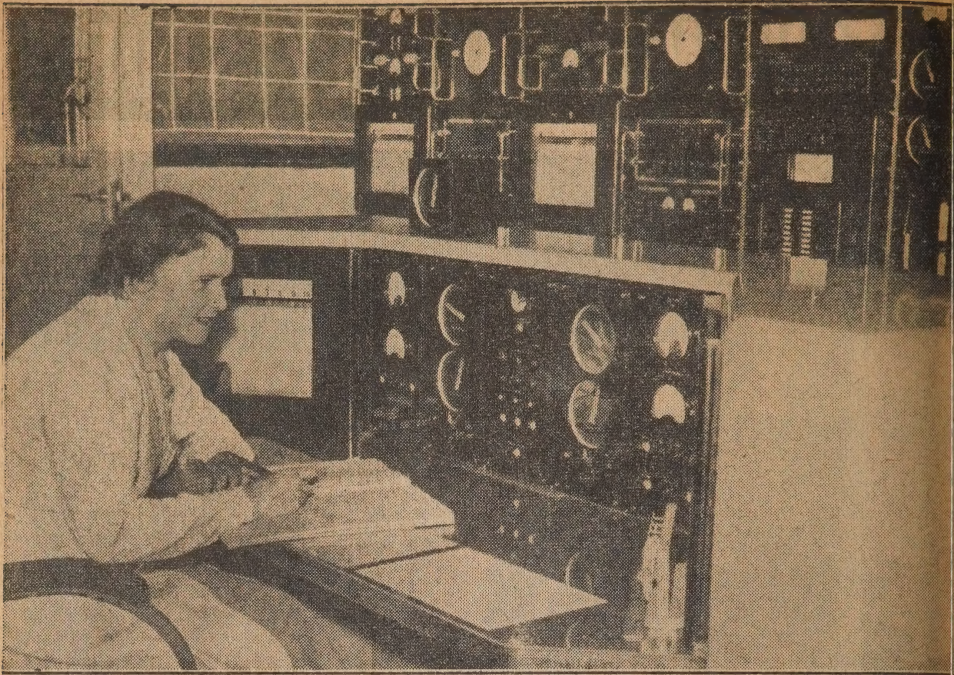
LUTONIUM IS DEADLY STUFF!



n urray, a mechanic from Birmingham, sets up a lathe at the Harwell Research Establishment, England. Murray has to wear s gainly rubber suit, whether he likes it or not, because the lathe has been contaminated by radioactive plutonium. Produced by action of natural uranium, plutonium is "poisonous" because of its radioactive qualities. (See following pages).



The 300-acre research establishment at Harwell is by no means a male stronghold. Here Mrs. Margaret Lees of Newbury, Berk is recording in the log book the operation of "Zeus", a prototype "fast" reactor, which is showing the way to more compact, efficient atom power plants.

BRITAIN REVEALS ATOM SECRET

Breaking a veil of secrecy, which for years has surrounded her atomic research, Britain cently admitted observers to her famous Harwell Research Establishment. They were sho existing equipment and told of the work which is in progress towards the establishment o whole series of atomic power stations.

BY T. S. MONKS *(London Staff Correspondent)*

IN a control room at Calder Hall on a desolate part of the Cumberland coast in the north of England, the needles on a battery of dials began to flicker. The nuclear reactor of Britain's first atomic power station had become critical; heat was being generated. Soon that heat will be working turbines to feed electricity into the grid system.

Work has already begun on other stations, including the futuristic steel ball at Dounreay on the northern tip of Scotland. Some of Britain's biggest industrial firms have rapidly expanding atomic sections as the build-up toward nuclear power increases in tempo.

The big atomic factories — for handling uranium ore, for enriching the uranium, and for plutonium separation — are improving and streamlining their techniques.

Behind all this is the famous atomic laboratory of Harwell, the research and experimental heart of the whole British system of nuclear power. On it rest high hopes for taking some of the power load off Britain's diminishing supplies of coal.

There are 5000 men and women at Harwell, who for years have been working behind a tight security fence on the edge of the Berkshire downs. They have been working on all aspects of atomic energy — for weapons and for peace.

Today, 10 years after Harwell was converted from a desolate RAF station, work is still being done for the physicists of the Weapons Branch but the bulk of effort goes now to the power program. Harwell, under Sir John Cockcroft, is responsible for the basic science and technology behind that program.

Two years were spent on the technology and feasibility study of the first power reactor now nearing completion at Calder Hall.

Many more years will be spen ing out and pilot-testing designs will be built during the next 20 These reactors will be more omical to run, more powerful an potentialities which cannot yet b assessed. There is no end in sigh

Recently I was allowed to go the security barriers at Harwe learn much of what is going on has been hitherto a scientists' t mystery.

With reactor design, only so progress can be made on paper laboratory experiment. There co stage when it is necessary to bu Harwell, therefore, there are a of reactors old and new.

There is still working one of t est — known as "Bepo" — a gr of a reactor with its thick c shielding reaching up about 4 ful for experiments, but as a re- ıtmoded.

a "slow" reactor in that the from its 40 tons of natural are slowed by means of a moderator. It is cooled by air day I saw it, it was working ver of about 6.5 megawatts.

" provided much information uclear reactor construction and, essential respects, the two big at the plutonium factory at le near to Calder Hall in Cum- are like it. They too are moderated and air-cooled.

" also played its part in work alder Hall power station. These, , have a different objective from Windscale. The Windscale piles the purpose of producing plut- the heat from the reactor goes .

alder Hall piles are primarily purpose of creating heat to be d into power. Plutonium made tural course in the reactor is a ıct, and its sale will help to off- .

r Hall is far from the last word. lesigned largely from a mass of acts, which had been assembled Harwell men as a result of their ents. There will be other power of the Calder Hall type, each improvement on the next. But e only the first stage of Britain's rogram.

ell is at work now on reactors e Two and they are investigating ıpetitors for this stage.

first is a reactor using heavy surround the uranium rods and the heat. The other uses as a moderator, but uses liquid to transfer the heat instead of will be used at Calder Hall).

uel for these reactors will be en- ıranium or plutonium. Natural U238 contains only 0.7 of the J235.

CORE

tical mass of natural uranium is ısly bulky; hence the size of the Bepo and the Windscale piles ıerland. The core of the reactors Two will therefore be consider- aller, but they are still posing oblems for the Harwell men.

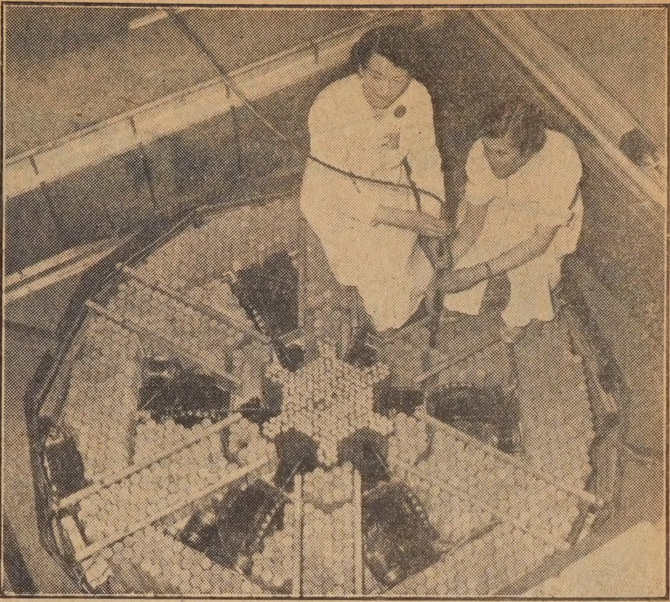
have meant the building of new reactors at Harwell. One I saw, named "Dimple".

is a materials testing reactor. vy water moderator is contained ınk which is surrounded by a reflector. Outside this is a radiation shield. The reactor submerged in the heavy water. the type of fuel and its arrange- the tank can be changed quickly what is, in effect, a different of reactor can be built up in a of a few days.

ple", at the time of my visit, ing the core of another reactor s also being built at Harwell.

will be named "Dido". It will moderated by heavy water, but much more powerful and its to provide a high level of neut- ıbardment for research purposes.

going up is a reactor named another one for testing mater- o heavy water cooled and mod- but of a more specialised type. el, it will use highly enriched alloyed with aluminium.



And here is the core of "Zeus", as the public saw it when Harwell was thrown open for inspection. For the camera, two lasses show how a neutron detector is lowered into the core which, incidentally, cost Britain several million pounds.

Fuel elements for future reactors will be irradiated in conditions closely resembling those in which they will eventually be placed. It will thus be possible to check heat transfer, radiation damage, corrosion and radiation decomposition.

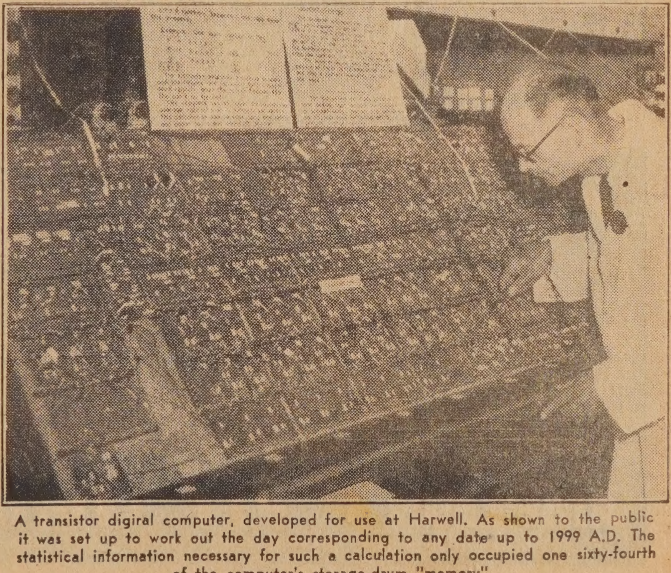
Yet Harwell has to look even further ahead. While Stage One reactors for the power program are nearing completion, and active work going on for Stage Two, Harwell physicists and chemists are experimenting and testing to see the type of reactors whose potential large scale application is not likely to be before the 1970's.

What is called the "fast" reactor is the first of this type and as an experimental one is to be put inside a big steel sphere up at Dounreay.

In the "fast" reactor there is no moderator to slow down the neutrons. It uses highly enriched uranium or plutonium and from a core of only 21 inches high by 21 inches wide will produce a power of about 60 megawatts.

Two precursors of this type have been built at Harwell, known as "Zephyr" and "Zeus".

Zeus, which I saw, is run at a power of less than 100 watts and therefore



A transistor digiral computer, developed for use at Harwell. As shown to the public it was set up to work out the day corresponding to any date up to 1999 A.D. The statistical information necessary for such a calculation only occupied one sixty-fourth of the computer's storage-drum "memory".

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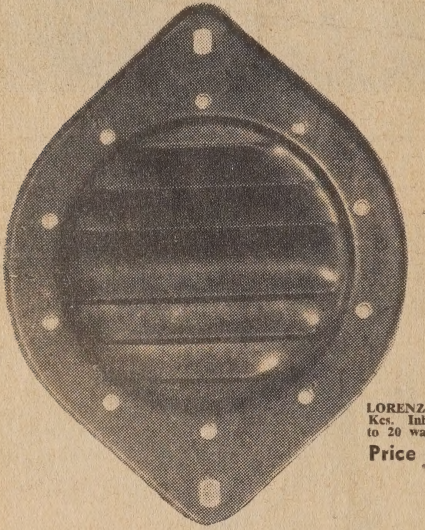

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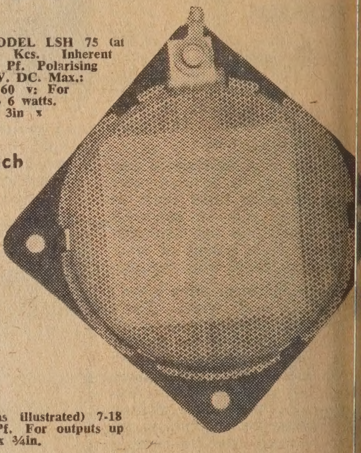

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PHONE K

BRITAIN REVEALS ATOM SECRETS

(Continued from Page 7)

ific interest but one that, he said,
away from practical application.
is means the chances of power
n use for the hydrogen-bomb. In
ntary terms, this is what is behind
esearch.

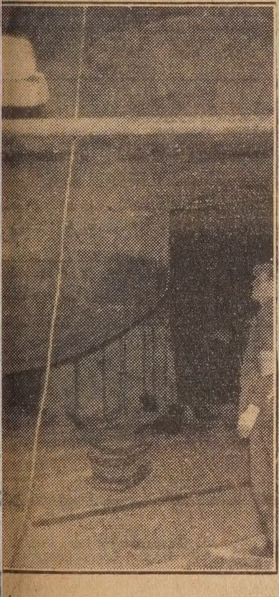
least stable nuclei are those either
e lightest atoms or the heaviest,
as those that are the most stable
in the middle.

re are two possibilities for the re-
of energy—either by the fission of
vy nucleus in which two nuclei are
d from one, or by the fusion of
nuclei. Fission is the basis of
c energy. Fusion, common in
, is much more difficult to bring
. Terrific temperatures have not
to be created but contained before
are dissipated.

Russians in their published experi-
have produced a temperature of
der of a million degrees centigrade
ey do not claim to have reached
trolled thermo-nuclear reaction.

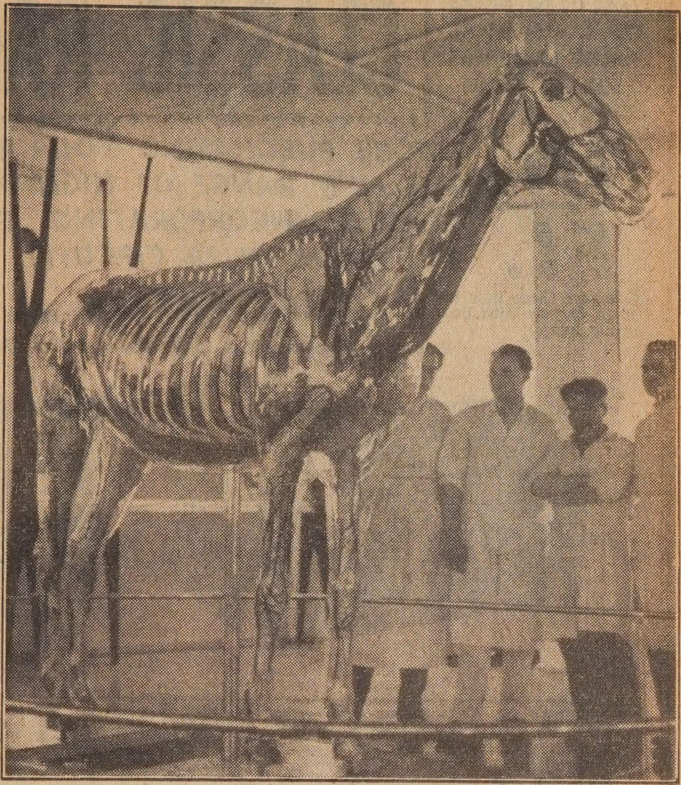
major advantage over conven-
atomic energy is not so much the
r release of heat and power but
limitless supply of fuel. There
nty of hydrogen about.

re was recently at Harwell a sym-
n on controlled thermo-nuclear
, but most of the Harwell chem-
hysicists and engineers have quite
h on hand with the problems of
ting power by means of fission.
n for power is not just around the
r.



bottom of the atomic pile, show-
the base of the pressure vessel—the
t modern of its kind in the world.
is installed at the new Calder
all power station, Cumberland.

PLASTIC HORSE AIDS SCIENTISTS



This life size plastic horse was one of the showpieces when the city of Dresden recently celebrated its 750th anniversary. It is made so that most of its anatomical features can be studied from the outside. The skeleton is of a light metal, the skin of a transparent plastic material, and arteries and nerves of colored plastic. A total of sixty three lamps illuminate various organs and a tape recording explains the exhibit to visitors to the Museum for Hygiene where it is housed.

A SELF-POWERED FOG HORN

IMAGINE a 4lb fog horn that can be heard a mile away! Such a device, powered by a liquefied gas, is now a reality—smaller and lighter than many portable radios, yet ready at all times for use on small boats, or as an emergency alarm in countless other situations on land or sea.

Power—110 decibels of it—is supplied by "Freon" fluorinated hydrocarbon propellant, originally developed 25 years ago as the ideal refrigerant. Ready instantly, the horn is independent of electrical or mechanical power, which often fails during an emergency.

The fog horn is trigger operated, and will send out two warning blasts per minute for three hours without recharging. Larger sizes are available, too, and all models may be recharged with liquid "Freon" after use.

The fog horn is produced by the same US firm which recently developed a fire alarm, also self-powered with "Freon", which goes into action when a metal plug melts as surrounding temperatures rise too high. It too can be heard for over a mile, according to the manufacturer, and is especially valuable for buildings which are rarely occupied, or which are not wired for electricity.

It is particularly useful in homes and industrial or commercial areas not covered by a continuous or frequent fire patrol. The extra minutes of warning the alarm provides often permit extinguishing the fire before it becomes a menacing conflagration.

Trigger-operated horns, similar to the fog horn, have been designed for emergencies in public schools and buildings, and for chemical plants, refineries and explosive plants where electrical devices might create hazards, or become ineffective in emergencies.

An even smaller trigger-operated horn—so small it can be carried easily—has been developed for guards, watchmen, police, payroll messengers and nurses. Equipped with a belt-hook for convenience, it can summon help from a mile away.

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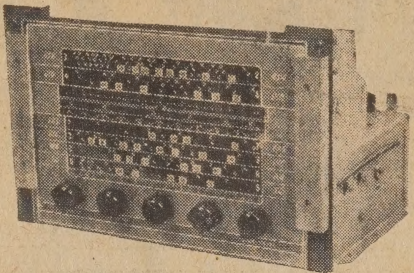

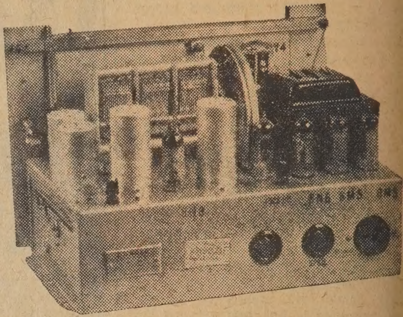

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acier landing is not just anybody's business, but rman Geiger, the Swiss "Glacier Pilot" has made his—and proved it by making about 5000 high-tude landings on the glaciers of Switzerland.

By RUSSELL HENDERSON

first glance it might look as if he helicopter had done away with ed for landing conventional planes at heights, but such is not the case. t experiments with the French n" helicopter on the Jungfrau, at tude of just under 12,000ft, proved although the "Djinn" can fly in arefied air, it still is not quite pos- to have it land, as it has a ten- to slide.

ger, with his "Piper Super Cub", of p, has managed to land and take- nearly 14,500ft in the Monte massif, a few miles from Switzer- Matterhorn.

h-altitude landing was, in fact, done itzerland as long ago as 1921 by viss pilot Durafour and the Ger- var-ace Udet, but this was mainly rt.

h Geiger, it's a business—and a ary one.

rtly after becoming the thousandth

☆

Right: Herman Geiger the Swiss pilot who lands his tiny plane in "impossible" snow country. His assignments have ranged from routine freight deliveries to mercy flights in time of national emergency. Below: This scene is typical of the country in which Geiger has to fly and land his plane.

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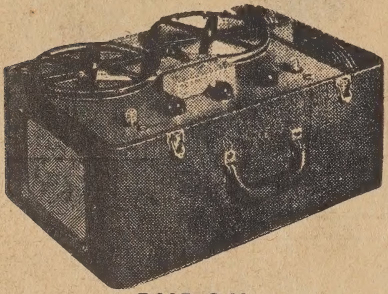

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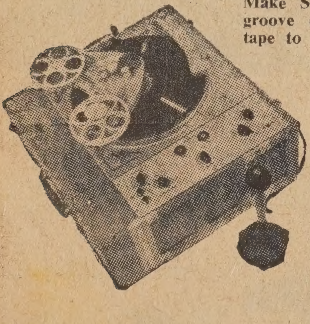

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105 ELIZABETH STREET, MELBOURNE

ilot, following on plenty of train- a home-made glider, Geiger got a of landing on glaciers regu-

he was a long way from his am- n those days, for financial reasons. l paid for his flying lessons by g planes at the little airfield of the Rhone Valley, and a plane own was out of the question for working as a mechanic in a motor garage. He had to wait

n Air Force pilot he learnt to he Alps and to respect both them eir swift and sudden currents. he landing idea running through in, he started dropping for high in villages and dam-construction

ping, he says, is more accurate aper than parachuting, and in the ountain regions there is generally now to cushion the drop.

Y OF DROPPING

e was plenty of dropping to do; er, mountain villages or the gangs -up construction jobs can be cut avalanches blocking the roads; r climbers can be injured; there lost to be searched for, given s and warm food.

witzerland, the vertical distances ngers of the high mountain coun- e led to the same need for air- s Australia's outback. Geiger got the idea of dropping fodder ountain animals after seeing chamois which had hanged them- while seeking food in the fir trees. e saved a mob of sheep by drop- ay, and now regularly, in the winter months, Geiger drops fod-

he terrible avalanche winter of Geiger had to deliver mail for t, when the trainline was blocked s; he's even dropped 360 pounds amite. In 1951 he dropped all od needed for building the above- -line Alpine Club hut above steg, saving weeks and even of portage for the builders.

for delicate goods, dropping was rough, and landing was needed, lly for getting the injured down valley hospitals in a matter of s and saving them the agony of a r-ride lasting hours or even days.

IER LANDING

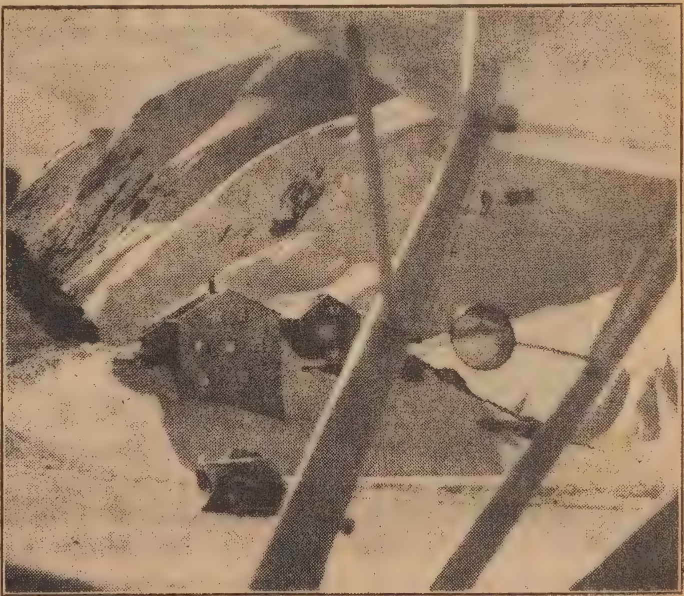
n 1952 Geiger did his first land- a glacier, the flattest surface to nd in the mountains. This one 00ft above sea-level, and carried the first light of dawn, whose shadows allow the pilot to pick y irregularities in the surface of w covering the glacier ice. Geiger e that he could even see the tiny waves the wind had made in the

he was getting contracts for land- ilding material, and for four , starting at 3 am on any day flying seemed feasible, he made ts a day. It's a split-second busi- here's no second run for land ecause there's no room. There he angle of the slope, the condi- the snow and distances—always to judge in the blinding snow y—must be estimated the first

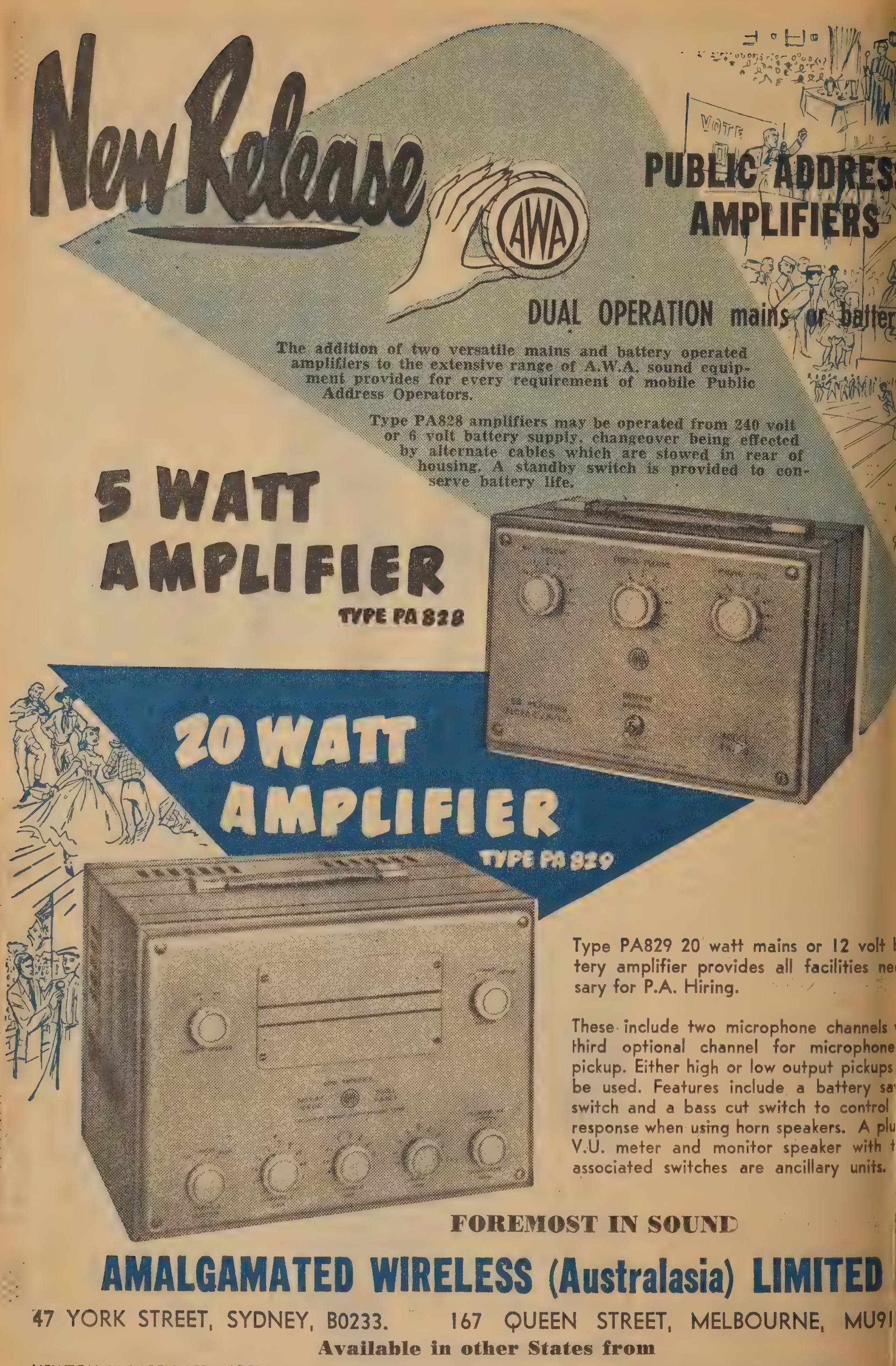
er can bring his craft down in a

(Continued on page 127)

The old and the new. Two alpine guides, used to footslogging it up the treacherous slopes, watch with interest as Geiger explains the special landing mechanism. Designed by Geiger, it allows either wheels or skis to be selected as required.



This hut—seen from the cabin of Geiger's tiny plane—was built largely from materials flown in by Geiger cheaper and faster than otherwise possible.



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Type PA828 amplifiers may be operated from 240 volt or 6 volt battery supply, changeover being effected by alternate cables which are stowed in rear of housing. A standby switch is provided to conserve battery life.

5 WATT AMPLIFIER

TYPE PA 828

20 WATT AMPLIFIER

TYPE PA 829

Type PA829 20 watt mains or 12 volt b
tery amplifier provides all facilities ne
sary for P.A. Hiring.

These include two microphone channels
third optional channel for microphone
pickup. Either high or low output pickups
be used. Features include a battery sa
switch and a bass cut switch to control
response when using horn speakers. A plu
V.U. meter and monitor speaker with t
associated switches are ancillary units.

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ALSO FROM LEADING WHOLESALERS.

COMBINATION MOVIE-TV CAMERA

nscious that both TV and motion picture systems have their limitations, US engineers
e recently developed a camera which produces both TV signals and motion picture film
from the same scene. Its use should benefit both the TV and motion picture industry.

of the major limitations of TV the difficulty of providing suffi- overage to justify the extremely osts usually associated with top productions. Co-axial and vave links frequently prove too ve, as well as being limited by nber of stations which can take cular program at the time it is ed.

m record which can be distri- to interested stations for use onvenient is a better and cheaper tion. The problem is to provide quality photographic print which ve a reproduced program tech- equal to the original.

L TECHNIQUE

most common method to date en to set up a motion picture in front of a monitor screen otograph the program exactly as y the audience. While simple production point of view—the film is already edited and or distribution as soon as it is —there are serious limitations to tem, particularly in the matter ire quality. When such pictures in presented over a TV system ality is degraded.

new camera, designed by the t organisation, is really two s in one; a TV camera using the ional pick-up tube, and a 35mm picture camera. A common stem is employed and a light prism divides the light beam rects a selected proportion to ction. The ratio of division is n the requirements of each.

when a TV show is broadcast, V camera will also make a ent film record and these films cut and edited into an exact py of the TV show. Due to her picture quality of such a it can be played over a TV with quality virtually equal to ginal transmission.

SAVING

ut down the time required to these films (three or more cam- ay be employed) an additional cord is made from a monitor which shows all the laps, fades and other cuts as made original show. With such a he various films can be quickly ed to make a high quality copy.

er advantage of the scheme is show which may be presented and white on TV can, if the of the subject warrants it, be re- in color on the film side of the This could be used later for ssion on color TV.

ersely, a TV color show could orded in black and white for distribution to stations having only black and white TV facilities.

In the DuMont system the film section of each camera runs continuously, the extra cost of film stock (it is claimed) being far outweighed by the convenience afforded when editing and the avoidance of the need for advance cueing to each camera in anticipation of it being called into the system.

OTHER OPINIONS

However, it does appear that some other organisations who are developing similar systems are inclined to foster the idea of running film through the camera only when it is actually being used by the TV network. While calling for more detailed instructions from the director to the cameras it would have the advantage of conserving film and extending the time during which such cameras could work without reloading.

From the motion picture industry's point of view the system also offers many advantages. Here it operates mainly as an electronic viewfinder for the film camera, enabling the director and as many others as may be interested to view the scene exactly as it is seen by the camera.

This is a very valuable facility and one which has been sought by the motion picture industry for a long time. Because, until now, there has been no satisfactory means by which the director could view a particular scene exactly as the audience will finally see it, it has been necessary to work largely on a trial-and-error basis.

Not until the film had been processed and screened would the director know whether it was exactly what he required—and by that time the actors, technicians, and other personnel would have dispersed and recalling them and setting everything up for a retake would be a costly business.

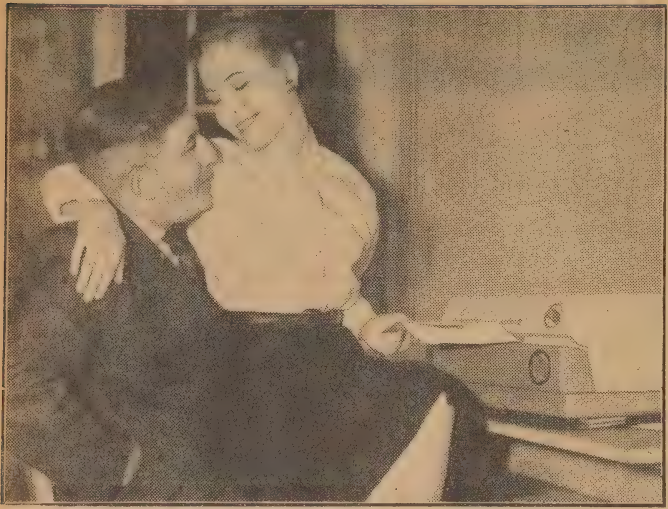
HIT AND MISS

For this reason directors normally make it a practice to shoot each scene several times; reasoning that by exposing sufficient film there is a fair chance that enough material will be available from all the shots to make one scene of acceptable standard.

But even this is a costly business—

(Continued on page 127)

It is a far cry from the old burning glass used to kindle a cottage fire—or by a schoolboy for practical jokes—to this highly efficient reflector designed to put the sun's rays to good use. Yet the principle is the same, it is only the larger size and efficient surface which enable it to cook your "hot dogs" free. This is just another step in the ever growing scheme to make practical use of solar energy.



Is this why Cal. Walters is all in favor of modern business methods? They leave his secretary free for little pleasantries! The gadget on the right will produce copies of any document in a few seconds, without any kind of preparation or processing. It never makes mistakes, never knocks off for lunch and doesn't demand overtime rates!

AUTOMATION IS A HOT SUBJEC

Automation is a word now on everyone's lips. It will have far reaching consequences on our dail lives—but what does the term mean? Why are labor and management alike concerned

by Calvin Walters

THE present tendency in industry and commerce is to rely more and more on automatic machinery to serve our needs.

More and more human beings are being replaced with machines which can carry out operations faster and more effectively than human operators. Machines attend machines.

That is why automation is such a "hot" subject just now, in the industrial sense. Management sees in it a solution to their costly labor problems. The worker, on the other hand, sees it as a potential threat to his job. Hence some of the current arguments and strikes overseas.

WHAT IS AUTOMATION?

The most concise definition of the word "Automation" I have so far encountered is "the operation of machines by other machines instead of by human beings."

This is just exactly what it is. Modern technology has progressed so far in the science of electronics that it has furnished us with the mechanical means to control a large number of sequential processes without the aid of human hands, other than to look after the maintenance of the machines.

By means of what are termed "transfer machines", pieces of work can now be loaded and unloaded into machines, transferred into other machines, lifted, turned in any position and worked to pieces of different dimensions.

The term "feed-back control" borrowed from electronic circuitry, is widely used when discussing Automation. Indeed, feed-back control is common to the various forms of automatic machines.

Feed-back control can also be called "self correction". Feed-back is a near-necessity for any automation.

The common furnace thermostat is the instrument used mostly as an example of feed-back control or self correction. This instrument is adjusted so that, when the temperature of the room in which it is housed rises above or falls below a predetermined and preset level, the fuel supply is automatically and correspondingly decreased or increased.

This means, in simple language, that a desired result is achieved by feeding back into the mechanism infor about performance. It achieve desired result by a correction in ation.

That is automation in a nutsh in the industrial sense it can't be r ed to the "machine controlling ma idea. It is all part of the general to use automatic machines and pr to replace human operatives. T sult, in some cases, has been quite ling.

In the radio set manufacturi dustry it has been the custom to c all components with wire, each being soldered separately into p according to a predetermined diagram.

Today, radio sets chassis are bei designed for automatic producti spraying, plating or otherwise p the wiring diagram directly on ceramic or plastic chassis or bas conducting material.

Thus the necessity for wirin soldering many small componen hand is being eliminated.

In 1953 the Ford Motor Co., plant in Cleveland, carried out a s ful reorganisation of some m units.

Certain machines were linked groups and these groups to other so that all the machines operated single unit.

The result of this was that, wit little human assistance, 44 aut machine tools together with 80 mation control units on a line 154 long, carried out 530 boring, d honing, milling and tapping oper This unit turned out 4000 engine daily from the rough castings.

PISTONS AND RINGS

In 1954 the Pontiac Motor divis General Motors set up an aut piston manufacturing line which out 2000 pistons per hour. In this the pistons move on continuous bel through chutes, without being to by human bands.

Dr. S. Lilley, who has recent turned from the Soviet Union, h scribed what he saw there in the kokonstruktsia Machine Tool B Factory. (These long names ar handy to me because they take u of space. I get paid by the line.

This is how Dr. Lilley describe he saw in the Stan . . . . . Factory they were making tractor piston r

"On cylindrical fixtures holding a time, the rings pass through a of stations which cut the gap, pr rings to close the gap and adj degree of spring, grind both extern internal surfaces (grinding stops matically at the right diameter), the external surface of one ring i

ind the surfaces, inspect all mea-
ts (with automatic ejection of
grease the rings, wrap them, box
nd load them on to a conveyor
the store. Labor requirements
iced from twenty-five to three."
ery", March, 1956.)

AND RACES

e Kaganovitch First State Ball-
Factory, Dr. Lilley saw a
which does almost the complete
of manufacturing ball-bearings
races automatically. The planned
on of this factory is 900,000 ball-
and 600,000 roller bearings per
four sizes each, with the aid of
) workers. These workers were
only in watching the machines'
ance and making adjustments
cessary.

ve some idea of the amount of
ved by the automatic operation
ines, we will refer back to the
otor Company's engine block in-
n.

the ordinary methods of manu-
it required nine hours from the
sting to the completely assembled
With automation, the same job
5 minutes. It seems almost in-
. The operation of drilling holes
kshafts was, at one time, done
machines and 39 men. It is
rformed by three machines and
n.

idea of automatic or even feed-
ntrol is not new. Away back in
Frenchman named Jacques de
son rigged up a silk loom which
olled by means of a drum pierced
es which automatically controlled
als and saved him a lot of work.
in 1784 a fellow named Oliver
of Philadelphia, made a flour mill
used no human hands from the
grain was received until it came
lour.

IC EXAMPLE

amiliar "governor" of a steam
which consists of two balls
l on a spindle, is a good example
feed-back control. This was in-
by James Watt about 1788.

speed of the machine increased
s were flung outward by centri-
rce and closed a valve feeding
the cylinders. Thus the en-
ed was reduced and the balls
n as the speed decreased. At a
point the valve opened and more
as fed to the cylinders and the
ained speed whereupon the cycle
ated.

governing devices are used today
-car engines to control the ad-
retard of the spark. The same
achieved by means of suction
motor. This actuates a dia-
which in turn "feeds informa-
t the distributor which advances
s according to the speed of the
d the load upon it.

out 1804 another Frenchman
always in the picture some-
named Joseph Jacquard, devised
which was operated by means
er roll punched something like
a player piano.

ilar device is used today for the
p of type in printing factories
of the Monotype machine. This
was invented many years ago and is as much a part of "automation" as any other modern device.

The machine has a keyboard like a typewriter and linotype machine. As the operator presses the keys for typing, a paper roll is punched with the holes in a position which corresponds with the letters of the alphabet or numbers, including all punctuation marks, spacing, margins and so on.

BOOK BY THE YARD

Thus the operator will type out a complete page of a book which is transferred to the paper roll in the form of punch marks together with the complete setting out of the spacing, etc.

When this paper roll is placed in another machine, it revolves like a player piano roll, whereupon air is sucked through the holes and releases the moulds for the particular letters required.

Molten type metal falls on to each mould in turn which then fall into a frame in exact replica of the printed page. The type is moulded one letter at a time hence the word "Mono"-type.

It will be appreciated that this method lends itself to a wide variety of machine controls. Corrections can be made in the paper roll so that mistakes are avoided and, provided that breakages of the paper are avoidable, the machine will render an exact performance of the "instructions" given it by the roll of paper.

In the printing industry one monotype machine controlled by one operator is able to set type faster and more accurately than by hand setting.

Of course, there is a limitation to the uses of the machines and hand setting and linotyping are still essential.

Many people have come to imagine automatic machines as "robots" of iron built like a human being with all sorts of mechanisms which enable the machine to walk about like some Frankenstein Monster, waving its arms and treading over everyone in its path, in order to reach its desired objective.

This is especially so with the much talked about "mechanical brains" or electronic computors. They have been credited with being able to ask and answer questions and to think.

"FUNNY" STORY

It reminds me of the story of one of those "speaking" weighing machines to be seen around "penny fun arcades". A very fat lady stood upon the platform of one of them, whereupon the machine said, "One at a time, please".

Electronic computors are nothing more or less than counting machines, though very complicated ones. They certainly make decisions as to yes or no but only based on certain instructions given to them beforehand. They have no choice other than those based on instructions which are built in, or are alterable.

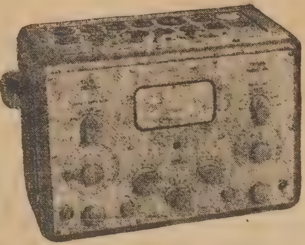
They can perform very complicated operations after having been "instructed" as to what is required and these computations are done without the intervention of human agency other than technicians to look after the complicated network of valves and relays.

A computor recently installed in a United States Defence Department and

These printed circuit panels are a far cry from the hand-wired chassis which have been used for years for radio and television receivers. Some locally-built TV receivers are already using printed circuit techniques.

Taylor
ELECTRICAL INSTRUMENTS LTD.

RADIO & TELEVISIO
TEST INSTRUMENTS



NEW VALVE TESTER Model 45c

A comprehensive valve tester which may be used to meas the mutual conductance of most types of British, American Continental receiving valves. Measures for over 4,000 diffe valves.

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CATHODE LEAKAGE: Tests for Heater/Cathode insulation up t megohms, with heater hot.
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HEATER CONTINUITY: Meter indicates continuity of heater or filam
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T.V. cathode ray tube adaptor, model 445 available.

PRICE £56/9/6 plus tax

SIGNAL GENERATOR model 67a

For Radio and Television up to 240 Mc/s.
The Colpitts oscillator circuit used gives good frequency stability and waveform over the wide frequency range.

FREQUENCY RANGE: 100 Kc/s-240Mc/s in six bands.
TOTAL SCALE LENGTH: 48in.
ACCURACY: ± 1%.
MODULATION: 400 cycles, 30% depth.
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Direct A.F. output provided.
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Automatic cut-out against mains overload.

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TAYLOR OSCILLOSCOPE Model 31a

An Oscilloscope of advanced design and reliable performance inter primarily to meet the requirements of T.V. and Radio Servicing Alignment, but its versatile features make it ideally suitable for gen laboratory work.

TUBE: Flat faced C.R. tube 4in. diameter.
Electro static deflection.
HARD TIME BASE: Covers frequencies from 10 c/s to 500 Kc/s, free runnin triggered.
AMPLIFIERS: Both horizontal and vertical with push-pull output are prov High gain amplifier band width 10 c/s to 6 Mc/s. Flyback Suppression Ci fitted with tube modulator.

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s of a second to make complex
ons. "It will make more com-
in one day than a thousand
beings can make in their life-
leyer Berger, New York Times,
r 10, 1954.)

y it is assumed by many that
matic control of an office will
out before complete automation
ory.

ATIC "BILLS"

of the American Railroads has
automatic reservations for pas-
The American Telephone Com-
l be installing a dialling system
automatic accounting and billing
will make the necessary com-
for costs of long distance tele-
lls.

merican Patents Office intends to
achines for searching the files
patents. When anyone lodges
with a patents office human
s commence an exhaustive
find out whether any similar
as been issued. This usually
nonths or years. Automatic
will reduce this time to negli-
portions.

Metropolitan Life Inusurance
ew York an electronic computor
aced 135 operators and 100
rd machines.

frightening aspect for most
is, of course, the result to their
such a wholesale replacement
by machines. Time alone will
hat one just as time has been
the same question since the
strial Revolution.
ing always seems to crop up to
hings out.

meantime man can look for-
the day when he can lay in
morning, happy in the thought
rything he requires will be
to by an automatic device on
instructions are "played" by a
d roll of paper.

S FOR THE DAY

l be a skilled worker attending
echnicalities of a machine but
e leaves for work at noon he
ruct" his own domestic "robot"
when he returns at four o'clock
quirements will be met.

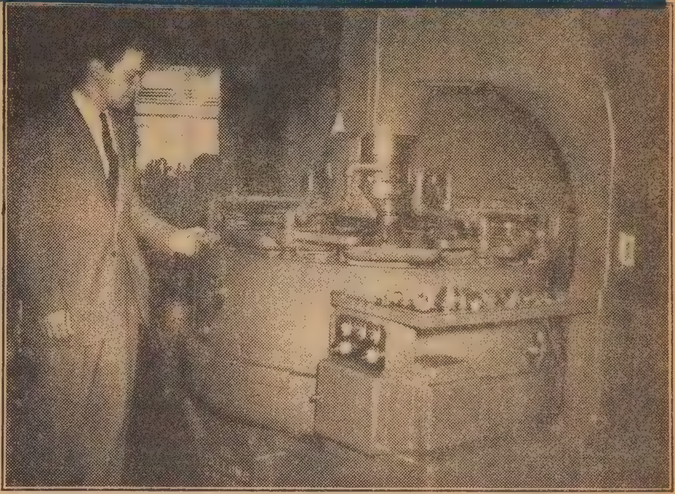
s bills will be calculated and
ally paid. His wife, if he needs
have all the housework auto-
accomplished. He will be even
ally nagged at, although this
well automatic as it is. Garden-
be easy and the car will drive

there will be no work at all
d man will have entered the
Age".

e will glory in his own accom-
s and finally, when he thinks
ained the ultimate in wisdom
ledge, he will die of withered
nd brains, because these will
further use to him. The world
eopled by machines and elec-
mputators.

on like this much longer you
a new Bertrand Russell has
I will now "transfer" to bed.
nt.

MACHINE WAS TOO INDUSTRIOUS



As for back as 1948, this automatic gear-cutting machine caused a strike of 15,000 men at the Austin works in England. The blanks pass through it automatically from one stage to the next, till they emerge finished, at the rate of 60 per hour. The machine cannot be stopped during its production cycle except for reasons of faulty workmanship.

INFRA-RED USED TO TRACK TARGETS

Designed to detect a target by noting the difference between its temperature and that of its background, infra-red detection apparatus has advantages over radar in certain applications, because it permits the design of a very simple detecting device and does not require a transmitter.

SPEAKING to a symposium of NATO's advisory group for Aeronautical Research and Development, Dr. Edgar W. Kutzscher, one time head of Germany's Electroacoustic Laboratories, explained these advantages to an audience in Munich.

Because it is a passive device, the enemy is not aware that it is in operation.

Also, it is very difficult to jam the infra-red detectors specifically, since the time interval in which the homing device is working is not known. Camouflaging the target by, for instance, painting it with material having a very small reflecting power in the infrared is useless, because reflection plays no part in the passive method of tracking and detecting.

Still another advantage lies in the difficulty of reducing infra-red radiation on targets such as planes without impairing the efficiency of the target's power plant. Infra-red radiation from hot parts of an airplane engine, especially the exhaust pipe and the exhaust gases, is sufficient to be detected at an "interesting range".

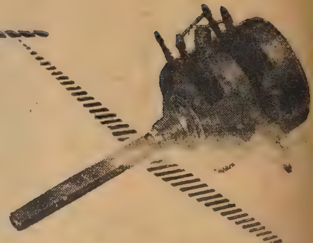
Variations are too great to quote with accuracy but, for example, a ship, the average temperature of which may be only a few degrees higher than the ambient temperature and the maximum temperature of which may be from 50 to 70 degrees centigrade higher than the ambient temperature, could be detected and tracked up to distances of five to 20 miles depending on its size.

Although infra-red homing devices have a relatively small range they are capable of the high accuracy inherent in optical instruments. A limitation is that such devices do not penetrate fog and clouds.

Discussing the fundamental structure of an infra-red homing device, Dr. Kutzscher explained, "The infra-red energy emitted by a target is gathered by an optical system and focused in a certain area of the focal plane, the size of which depends on the focal length of the optical system and the desired field of view of the device. After scanning the field, the infra-red energy is then concentrated onto the infra-red detection element using optical components. The output of the photocell is amplified and the final intelligence must be transferred in a usable manner to the missile control."

Infra-red proximity fuses have also been developed. The lead sulphide photocell is installed in the nose of the missile perpendicular to the missile length axis. During the flight the output from the cell increases with decreasing target range, reaching a sharp maximum at the smallest distance between missile and target. The pulse is amplified and used to control a release for operating the fuse.

IRC
AUSTRALIA



LOUDNESS CONTROL

has been designed to replace your existing volume control

and to provide correct high and low frequency compensation as volume is reduced . . . thus maintaining the correct tonal quality right down to whisper level.

(Patent Applied for No. N11262)

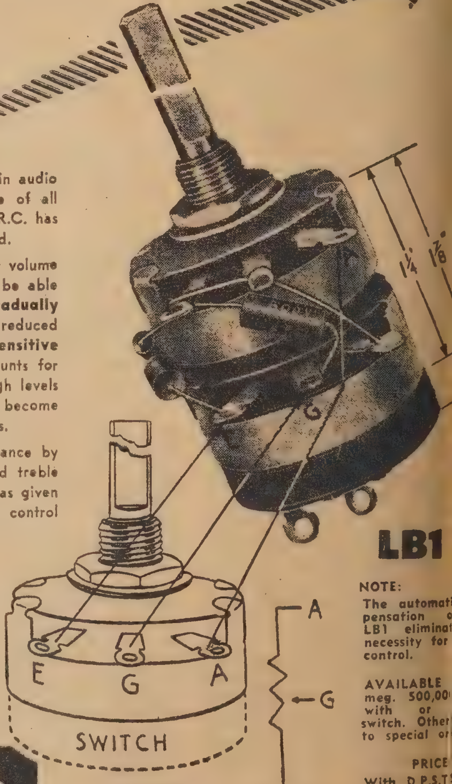
For many years there has been a need for a volume control in audio systems which would automatically keep the proper balance of all frequencies within the audio range at **any** listening level. I.R.C. has developed such a control, known as the LB1, to meet this need.

With the loudness control it is possible to reduce the output volume of any good or average audio system to a whisper and still be able to hear every tone with perfect balance, as the LB1 **provides gradually increasing high and low frequency boost** as the volume is reduced to offset the deficiencies of the human ear, **which is insensitive to high and low frequencies at low volume.** This accounts for the reason why many audio systems are operated at such high levels to give the best listening effect and in this process they become annoying to other members of the household and neighbours.

Many attempts have been made to obtain correct tonal balance by means of tapped volume controls, various types of bass and treble boost circuits and stepped type loudness controls, but none has given the performance of a truly continuously variable loudness control such as the new I.R.C. LB1.

The I.R.C. new loudness control consists of two separate volume controls operated from a single shaft of standard size and used with a combination of capacitors and resistors which are already wired. The unit will replace any volume control by transposing 3 simple connections, as indicated by the illustration at right. Can be fitted without experience.

Contact your usual supplier for illustrated literature.



PRESENT VOLUME CONTROL

LB1

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(50 yards from King St.)

Technical Review

V-BRILLIANT LAMP HAS MANY INDUSTRIAL USES

**to be the brightest incandescent lamp ever sold commercially, a
t development by the Sylvania company (USA) has several unique
res. One of these is the small area of the light source, a feature
makes it particularly suited to many applications for which more
conventional lamps are unsuitable.**

Y incandescent lamps had car-
n filaments, but these lamps
run at relatively low brightness
cause of the rapid rate of car-
poration. Tungsten provided a
f obtaining much greater bright-
l has been used ever since.

ast 50 years have seen no radi-
nge in incandescent filament
but recent developments, in
/, widescreen movies and fast-
computors have emphasised the
an even brighter incandescent
These applications also demand
iformity in the light source than
btained from a coiled filament.
equency heating of a tantalum
disc provided the answer.

light source is a 5/16-inch-
disc of tantalum carbide sur-
by a silver-plated copper cylin-
ch concentrates the magnetic
t at the disc. The oscillator tank
laced around the lamp, closely
to the copper cylinder (Fig. 1).

ENTRATED POWER

ore, in effect, the tantalum car-
becomes the final sink for most
adio-frequency power generated
oscillator. Since the eddy cur-
veloped by the alternating mag-
eld produce circular currents
disc, heating is uniform and
ical. Therefore, the light pro-
the incandescence of the disc is
across its entire surface.

rmore, tantalum carbide has
igh melting point and its rate of
ion is so low that it can be heat-
very high temperature (3400
This produces twice the light
are millimetre of surface area
any known incandescent lamp
five times longer as well.

-cooling tubes are inserted
glass-to-metal seals in the base
mp. The tubes are attached to
er cylinder and keep it cool.
not for water cooling, the tre-
currents would melt the cop-

dio-frequency source consists of
A triodes operated as a self-ex-
sh-pull oscillator. A 15-turn
bing tank coil and a 350-uuf
capacitor provide a parallel-
nk circuit resonant at approximately 3.5 mc. Bypass capacitors and rf chokes prevent the dc plate voltage from appearing on the tank coil. This arrangement produces a 1.5-kw output with all components operated well within their ratings.

Both power supply and oscillator are completely shielded and rf filters are placed in the power-line connections, keeping the radiation well under 10 microvolts at ¼ mile from the installation to prevent radio interference.

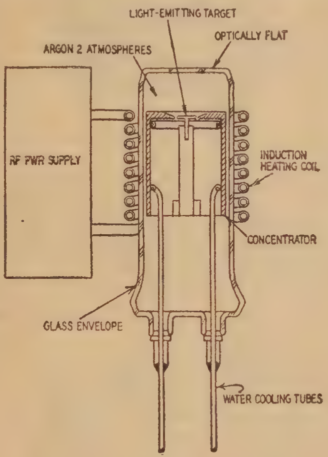

Figure 1. This diagram shows the essential parts of the lamp. Note small area of the target which gives the lamp its unique characteristics. It has several industrial applications.

Although the lamp was originally designed for motion-picture printing, it has found its way into some interesting electronic applications — color picture-tube processing, computer readouts and instrument landing beam checkers.

Color picture tubes depend upon a photographic process to produce the three-color dot clusters which make up the light-emitting surface. In the finished tube an electron beam will pass through small holes in the aperture mask and excite one of the three colors. It is essential for good color reproduction to have the proper color phosphor dot precisely aligned with respect to the aperture mask holes and the electron gun.

The light beam which exposes the photo-resist phosphor and also determines its position, must follow the same path, as will the electron beam in the finished tube. The light must therefore come from a concentrated source approximating the dimensions of the electron beam at its origin.

CUTS COST

The rf lamp not only provides the necessary concentrated source but also greatly speeds up the process because of its high brightness. Although there are still other costly processes in the manufacture of color tubes, the rf lamp has a good chance of significantly reducing the cost of an important one.

The rapid advances in electronic computers have resulted in a peculiar dilemma. They can think faster than they can talk! Computation and reference to data in their memory is limited only by the speed of an electron in a valve or the migration of a hole in a transistor, but communication of the results to the outside world has generally depended on some slower mechanical device.

Recent developments in the readout or communicating section have made use of a combination of light beam, electron beam, and photographic emulsion. All these phenomena are fast, especially if the light beam is bright. The rf lamp looks very promising for this application and speeds of 10,000 digits or letters per second may soon be realised.

AVIATION

Still another use may be connected with electronics in aviation. The high frequency ILS beam used to guide aircraft in for landing sometimes drifts from its desired position, a very serious situation. Present methods for checking the position of these beams is time consuming and costly.

A light beam does not stray from the path upon which it is directed, and, therefore, might be used as a reference beam which a pilot could use in good weather to check the radio beam. The problem was to get a sufficiently narrow light beam, bright enough for good visual tracking. The rf lamp has characteristics which seem to solve this.

Thus one more industry—illumination—is being advanced through electronics. (Radio-Electronics, May, 1956.)

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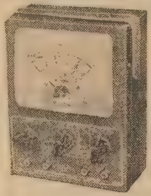
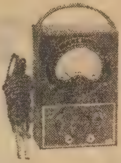


AC-DC MULTIMETER

Model MVA/2: This popular Multimeter is built to careful standards of accuracy and utilises 1 pc resistors throughout to ensure maximum efficiency. It covers AC-DC and output voltage ranges up to 1000 as well as D.C. current ranges up to 250 milliamperes. In addition there is a special 10 ampere D.C. range as well as four ranges of resistance up to 1 megohm.

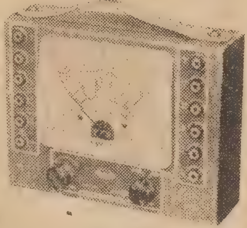


DC PORTABLE MULTIMETER

Model D.C.M.: This self-contained Multimeter is small and readily portable and is suitable for quick checking of circuits . It covers D.C. voltages up to 500 as well as D.C. current up to 250 milliamperes. Two ohms ranges are provided and it comes complete with test leads and instruction booklet. .. .. —

MODEL ACM

An AC/DC Multimeter readily portable reading up to 500 volts both AC and DC as well as direct current in several milliampere ranges. Self-contained resistance readings to 100,000 ohms. £14 plus Sales Tax 12½ pc.



MULTIMETER—MODEL MK1

Has a wide range of AC and DC voltages up to 1000 volts and measures current in the range of 1, 10, 50 and 250 milliamperes, and resistance readings up to 100,000 ohms. Has U4 square meter with clear Multi-Scale. Supplied either as a kit or assembled. Assembly from the kit of parts is easy, wiring instructions and constructional details are given and photos and diagrams make the job easy. Write for details.

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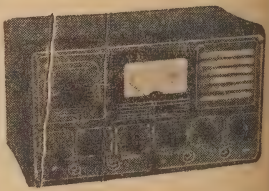
Model YOA. Gives dynamic on-the-beam performance, and new Vernier or fast drive dial makes for quicker and easier tuning. Has improved attenuation system and the dial is calibrated in spot frequencies for quick tuning over the main alignment points merely by changing the switch. Has continuous coverage from 30 megacycles to 150 KC in overlapping bands. Write for free illustrated leaflet.



SIGNAL TRACER and V.T.V.M. —MODEL AST

Here is a Sensitive Signal Tracer with a Vacuum Tube Voltmeter which brings fault finding in service work to a stage where faults can be quickly located and analysed. Brief specifications are: Power: 240 volts, 40 to 60 cycles. VTVM: 0/5, 0/25, 0/100, 0/500 Volts AC and DC. The signal tracer covers from 175 kilocycles to 18 megacycles. A leaflet is available on request.

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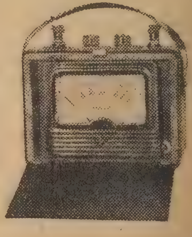


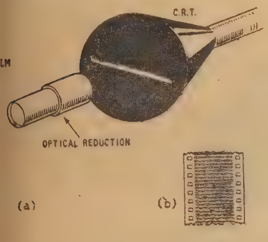
Model EXT/2: Readily portable, this low and medium range ohmmeter is mounted in hard rubber case with hinged protecting flap over the meter Uses 4in square meter Model R4.—Ranges 0.20, 0-500, 0-5000 ohms. £ 1 plus Sales Tax 12½ pc.

OVEL SUGGESTION FOR TV FILM RECORDING

ny methods of recording TV programs have been tried, varying from direct photography electrical recording on high speed tape, yet none of these is without serious disadvanes. The following scheme, described in a recent issue of Wireless World, is suggested by the author as a possible approach having a number of advantages.

EN a television programme is to be recorded for later re-transmis- e usual method is to employ ap- consisting basically of a cine- mounted in front of a television to photograph the images which on the cathode-ray tube screen. are certain drawbacks to this ar- ent, which results in a loss of on obvious to anyone who has sed a "telerecording".

loss of definition springs from ources in the long chain of pro- which the picture elements must between leaving the camera and l display on the receiver cathode- e, but the most degrading are (a) copic effects, and (b) the finite the spot (hence the lines) and the f the c.r.t. used for recording. e are others, of course, but most



e 1. (a) Essentials of the proposed ding system with (b) showing how ssive traces would appear on the film.

se are common to the ordinary on transmission of cine films, and ignored as they introduce no dis- other than that considered nor- satisfactory picture reproduction.

proof of this is that a transmis- normally photographed cine film BBC television service gives a cture equal and very often super- hat of live broadcasts.

system to be described proposes inate (a) above and reduce (b) rable limits by recording the pic- lements on 35-mm film without oducing a picture recognisable as ntil it is reproduced on a monitor vision receiver.

cine film could be made to travel ough, say 200 feet per second, e electrical signals from a tele- camera could (assuming suitable ers) be injected into the normal track of a 35-mm sound film, he 3-Mc/s picture components be recorded in variable area and fter processing) reproduced.

200 feet per second could, be- nodern film emulsions have a very in size, be reduced to say 100 feet ond, if special care was devoted slot and optical arrangement to thing of the light modulator.

rtheless, the suggestion is quite tical, because very long lengths of ould be required for a 15-minute n, and the mechanical problems attendant on such fast-moving film would be almost insurmountable.

If, on the other hand, the film is moved at normal or twice normal speed and the recording slot if made to travel over the film, or, more correctly, made to appear to travel at the required speed over the entire usable surface of the 35-mm him (not just one edge), then the system becomes more practical.

NON-MECHANICAL

Further, if this apparent rapid movement of the "slot" is produced by electronic means, then there will be no extra mechanical problems to solve. Such a movement could be achieved in the following way. A spot is made to traverse continuously from left to right the face of a cathode-ray tube in much the same way as in an oscilloscope.

The movement is produced by a timebase synchronised to the line pulses and applied to the X plates. The Y plates of the tube are energised by a 15-Mc/s radio-frequency voltage giving a vertical deflection of, say, 1 inch. This r.f. is modulated by the picture signal from the camera.

The effect of this is to produce a vertical bar of light which is swept across the face of the tube and whose height at all instants is proportional to the picture modulation. This is now reduced by optical means so that the resultant image is less than 1/200 of the height of a 35-mm film frame and the length of sweep is just sufficient to go from one edge of the usable film to the other.

This arrangement is shown in diagrammatical form in Fig. 1 (a). If the sensitive film is now moved continuously past the optical system a trace will be recorded on the film similar to that depicted in Fig. 1 (b). The similarity to a television raster is obvious, but of no great significance.

REPLAY

To replay this recording after processing requires but to pass the film through the apparatus again, with the "slot" now unmodulated but scanning as before, and pick up the light variations produced by the recording on a photoelectric cell.

Before going into details about the modulation and intricacies of ensuring correct registration during playback, the following points should be noted.

(1) That this is a proposed system for recording in black and white the equivalent of the electrical waveforms produced continuously by a television camera or transmitter and need therefore take no account of interlacing or frame synchronising.

(2) In a television system of 400 lines and a bandwidth of 3 Mc/s there are some 600 picture elements per line, i.e., a picture with maximum possible transmitted detail would only produce 300 sine waves per line.

(3) About 15 pc of any line time is devoted to the sync pulse and associated "porches".

The modulation of the radio frequency applied to the Y plates differs from conventional practice inasmuch as only the top half of the envelope is allowed to vary. The lower half is clipped by diode action and therefore never displayed. The depth of modulation never exceeds 70 pc.

The effect of these restrictions will produce a display similar to Fig. 2. To understand the need for this, we must look in detail at what a portion of a recording would look like and how such a recording is played back.

Just as in conventional sound-on-film recording, the length of a slot of light is made to vary in sympathy with the electrical equivalent of sounds, and there are push-pull tracks and single-sided tracks, so this system is recording vision-on-film by making the length of a slot of light vary in sympathy with the electrical modulation components of a picture.

SINGLE SIDED

The system chosen is a single-sided-track recording because, unlike the sound track, where reference can be provided by the black edge of the film, in this case the reference edge must be provided during recording much as it is done on modern sound-track recorded with suppressed-silent-passage techniques

No such refinement is proposed here, but the reference is produced by the clipped lower edge of the modulation. This edge provides the reference required by the next scan, and so on. Notice that there is no need, therefore, for accurate location of the trace on the tube or film during recording. Fig. 2 shows what an enlarged section of recording might look like.

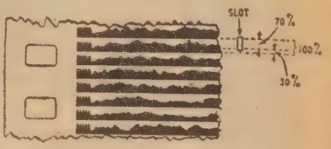
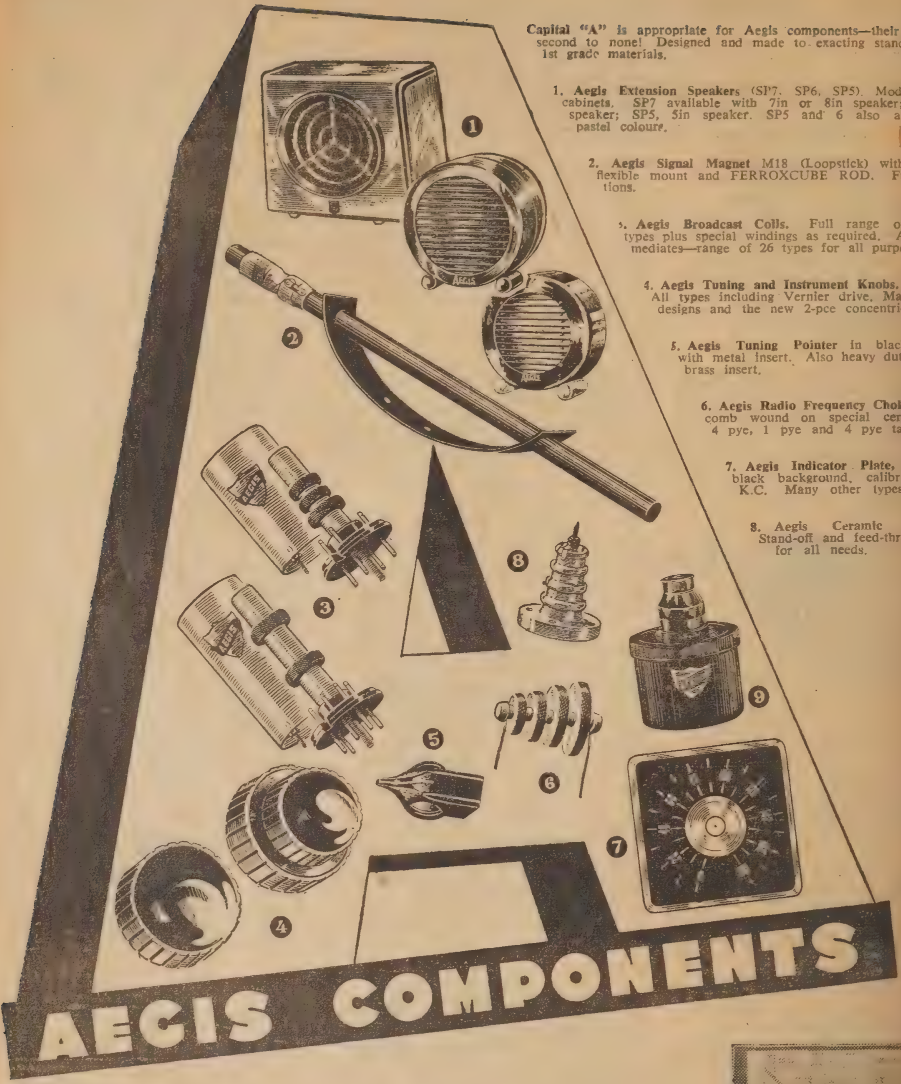


Figure 2. Magnified section of the film showing the position of the recording slot (right) relative to the traces it produces. Note the 1 Mc burst at the beginning of each line.

We have glossed rather quickly over the recording techniques, because there are certain requirements during the playback operation which influence the recording system, and they must be understood before returning.

When a film is run through a camera, even though it be a continuous-motion camera, there is always a certain amount of "wandering".

Refinement of the film-moving mechanism would be expensive and tedious, so the solution is to nullify the effect of the wander by means of a servo circuit which automatically alters the



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up the output of the modulator on its way.

This playback servo chain is, of course, fed from the photocell output via the video amplifier, which also feeds the monitor and transmitter. During the playback the 15-Mc/s oscillator and modulator will still be required because the "slot" is produced by the output of the modulator but, it will be remembered, this r.f. is partly suppressed during flyback to allow sampling of the I-Mc/s beam positioning burst.

This suppression is achieved by injecting line-blanking signals into the modulator during playback. The last block is the time base which is quite conventional. All the circuits which feed the tube deflection plates have been shown as single-ended for simplicity, but would, in practice, be push-pull for the usual reasons.

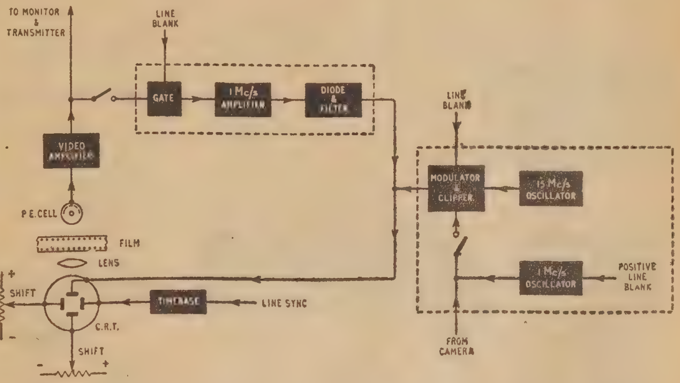


Figure 3. Block schematic of the system, giving some idea of the kind of circuits required. The recording chain is in the right hand dotted square, while the playback servo circuits are in the top dotted square.

The limitations of the highest recordable frequency on such an apparatus are expected to spring from three main causes: (a) finite spot size and halo (b) afterglow, and (c) tube-screen grain and film-base noise; also the film emulsion.

The effect of (a) will be minimised, apart from using a special c.r.t. fluorescent screen material, by making this tube as large as convenient and running it at high voltages to ensure a sharp focus and, if possible, running it at such a low intensity that the halo is below the "knee" of the film emulsion characteristic.

AFTERGLOW

Regarding (b), afterglow will show up on both the recording and the playback operations as fogging and noise. The "fall away" of glow in oscilloscope tube screen is rapid during the first few micro-seconds, but flattens off with time, so that the above remarks about operating near the "knee" of the response curve will apply here.

On the question of (c), the problem of screen grain will be expanded later. Film-base noise will presumably be of an order equivalent to that produced with standard photographic picture techniques.

A possible way of reducing this is by having a white opaque base and picking up the light modulation on the photo cell by reflection from the emulsion side, and not by transmission through the film base at all.

The capacity of the emulsion to record clearly the small details should be quite adequate. The amazing definition achieved with the so-called "microfilm" is ample proof of this.

Calculations show that video amplitude compression could be used before recording, to re-establish a better relationship between height and breadth detail on the film. The effect would be to curtail drastically the not very often used peak-whites and boost the lower and middle contrasts.

The playback amplifier would have a circuit of opposite characteristics to restore to normal. A curve of this form would increase the smallest contrast to four times the previous, so the net smallest detail becomes (1/1250) x (1/600) where the frequency component of the signal is still less restricted than the amplitude component.

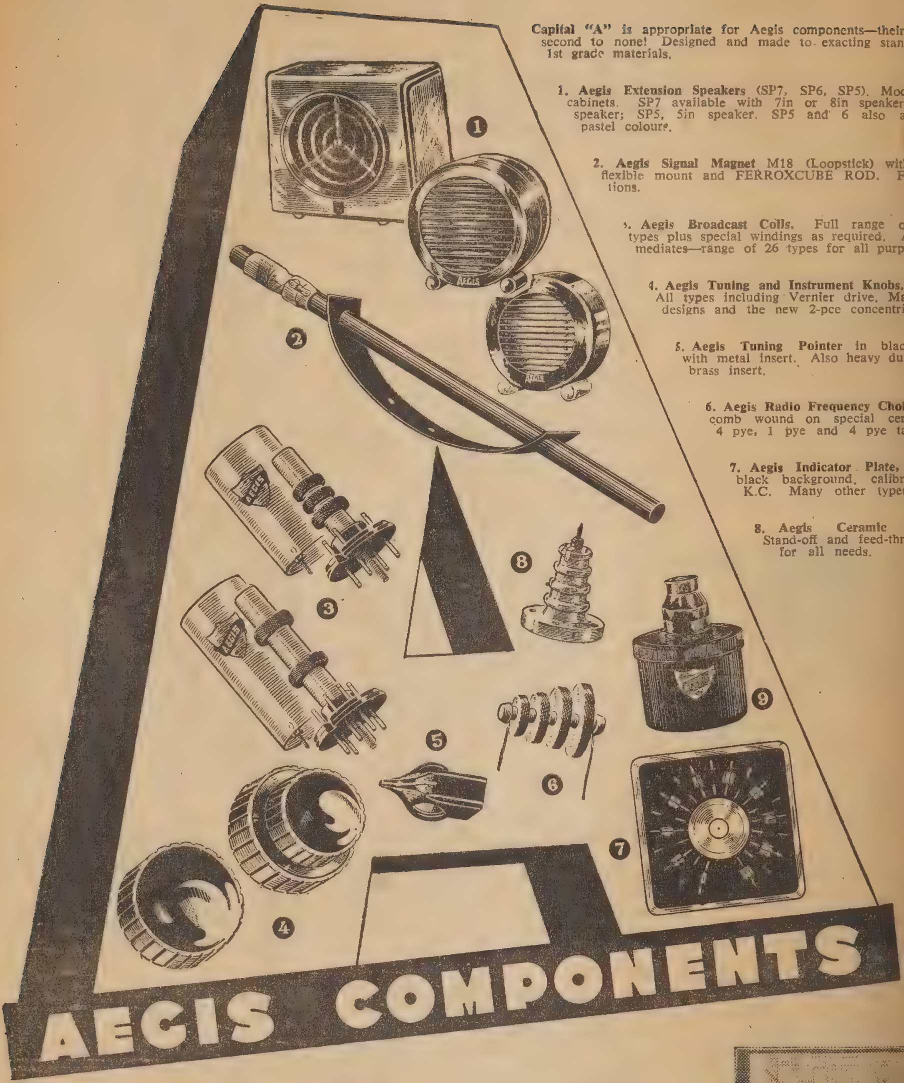
On the other hand, advantage can be taken of this two-to-one asymmetry to reduce the film speed by half and record two consecutive television lines across the width of the film (the time-base repetition frequency must also be halved).

OPTIMUM "SLOT"

From these calculations we can establish the aspect ratio of the "slot", which should be at least half as wide as the smallest horizontal detail, i.e., 1/1200 or less than one thousandth of an inch, and have a height for playback of approximately three thousandths of an inch, a ratio of approximately 4:1.

If a tube with 10 inches of useful scan is available, then the spot must be 1/1200 of this, which is 1/120 of an inch—quite a tall order, but achievable. (The present "flying spot" film transmission is quite adequate.)

If the height of the slot at maximum was measured on the tube it would be only 1/32 of an inch, which implies that the smallest contrast (vertical) detail might be lost in the screen grain. To circumnavigate this the maximum height of the slot measured on the tube should be increased to one inch and the aspect ratio restored by optical means before reaching the film. (Wireless World, March, 1956.)



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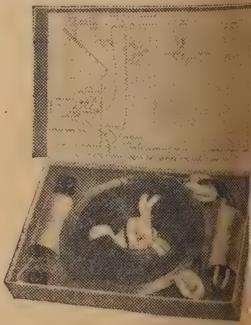

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ile recording.

back servo circuits (top left)
of a sampling gate, which
y during line blanking, feed-
r.f. 1-Mc/s amplifier which
ds a diode rectifier and RC
rk. The output of this net-
plied as a d.c. shift potential
lates of the c.r.t. and picks
up the output of the modulator on its way.

This playback servo chain is, of course, fed from the photocell output via the video amplifier, which also feeds the monitor and transmitter. During the playback the 15-Mc/s oscillator and modulator will still be required because the "slot" is produced by the output of the modulator but, it will be remembered, this r.f. is partly suppressed during flyback to allow sampling of the 1-Mc/s beam positioning burst.

This suppression is achieved by injecting line-blanking signals into the modulator during playback. The last block is the time base which is quite conventional. All the circuits which feed the tube deflection plates have been shown as single-ended for simplicity, but would, in practice, be push-pull for the usual reasons.

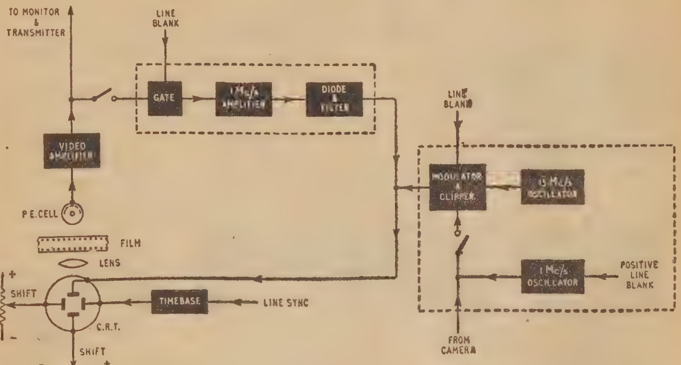

Figure 3. Block schematic of the system, giving some idea of the kind of circuits required. The recording chain is in the right hand dotted square, while the playback servo circuits are in the top dotted square.

The limitations of the highest recordable frequency on such an apparatus are expected to spring from three main causes: (a) finite spot size and halo (b) afterglow, and (c) tube-screen grain and film-base noise; also the film emulsion.

The effect of (a) will be minimised, apart from using a special c.r.t. fluorescent screen material, by making this tube as large as convenient and running it at high voltages to ensure a sharp focus and, if possible, running it at such a low intensity that the halo is below the "knee" of the film emulsion characteristic.

AFTERGLOW

Regarding (b), afterglow will show up on both the recording and the playback operations as fogging and noise. The "fall away" of glow in oscilloscope tube screen is rapid during the first few micro-seconds, but flattens off with time, so that the above remarks about operating near the "knee" of the response curve will apply here.

On the question of (c), the problem of screen grain will be expanded later. Film-base noise will presumably be of an order equivalent to that produced with standard photographic picture techniques.

A possible way of reducing this is by having a white opaque base and picking up the light modulation on the photo cell by reflection from the emulsion side, and not by transmission through the film base at all.

The capacity of the emulsion to record clearly the small details should be quite adequate. The amazing definition achieved with the so-called "microfilm" is ample proof of this.

Calculations show that video amplitude compression could be used before recording, to re-establish a better relationship between height and breadth detail on the film. The effect would be to curtail drastically the not very often used peak-whites and boost the lower and middle contrasts.

The playback amplifier would have a circuit of opposite characteristics to restore to normal. A curve of this form would increase the smallest contrast to four times the previous, so the new smallest detail becomes (1/1250) x (1/600) where the frequency component of the signal is still less restricted than the amplitude component.

On the other hand, advantage can be taken of this two-to-one asymmetry to reduce the film speed by half and record two consecutive television lines across the width of the film (the time-base repetition frequency must also be halved).

OPTIMUM "SLOT"

From these calculations we can establish the aspect ratio of the "slot", which should be at least half as wide as the smallest horizontal detail, i.e., 1/1200 or less than one thousandth of an inch, and have a height for playback of approximately three thousandths of an inch, a ratio of approximately 4:1.

If a tube with 10 inches of useful scan is available, then the spot must be 1/1200 of this, which is 1/120 of an inch —quite a tall order, but achievable. (The present "flying spot" film transmission is quite adequate.)

If the height of the slot at maximum was measured on the tube it would be only 1/32 of an inch, which implies that the smallest contrast (vertical) detail might be lost in the screen grain. To circumnavigate this the maximum height of the slot measured on the tube should be increased to one inch and the aspect ratio restored by optical means before reaching the film. (Wireless World, March, 1956.)

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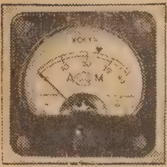

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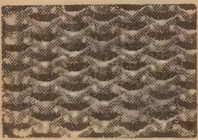

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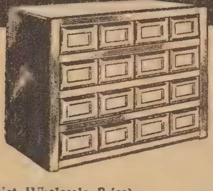

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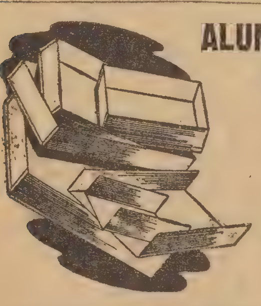

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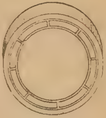

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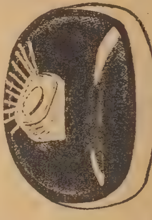

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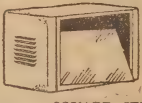

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FROM THE EDITOR—OVERSEAS

THE TELEVISION SCENE IN FRANCE AND BRITAIN

rather paradoxical that, although only a few miles of water ate France from Great Britain, their TV standards are so different. Had their TV activity developed at the same rate, with the diate prospect of programme interchanges, things may have been ent. But Britain was the pioneer, and after the war elected to carry on where she left off in 1939.

E has the most elaborate video m in the world. She uses a vith 819 lines per frame, re- video bandwidth of 10.4 Mc otal channel width of 14 Mc. on the other hand has less the number of lines — 405 — a video band of only 3 Mc al channel width of 5 Mc. Both sound and are the only countently listed who do so. All the e FM.

therefore rather fascinating to ne French TV pictures and to them a day or two later with n a British receiver in London. ed in Paris for the first time 'ening at Easter, to find that isians had departed for the leaving only five million or so he fill the vacant spaces. My right alongside the Louvre and ies Gardens, which is the same that it was right at the centre orld's most beautiful city.

walked through the doors, a tue of Jean d'Arc reminded me oric struggles in past centuries s between England and France ost national pastimes. And if ave forgotten it, the triumphal l memorials of Napoleon's ex- re all around to jog my

NT MEMORIALS

f these are almost alongside cted in later years, eloquent of er and more tragic battles in l soldiers of France and of ld fought and overcome com- ies who, once more, used this neir battlefield.

tory which the visitor finds the streets is perhaps the most ing about Paris, for at every r is a new chapter to be read. d not need to hunt it out as in other places. Every Govern- ling flies the French Tri-color. n boulevarde leads to the Arc de Triomphe, beneath the flame that flickers at the he Unknown Soldier. place, from which the ground on all sides, every man who y find a message which does to France alone, but which pcial poignancy in a country suffered so much in destruc- ne struggle for liberty.

he rest, it is dominated by the Champs Elysees, now buried greenery of the famous chest- s broken by the Place de la ewhere the guillotine once where German tanks battered gs at the liberation of Paris rld War II.

Today the fountains gleam in the sunlight. The traffic sweeps up to the Arc de Triomphe and the Avenue of the Grand Army beyond, and the march of Hitler and his hordes along it which broke so many French hearts is swallowed up in the history of yesterday.

When the Eiffel Tower was opened in the last century to become a wonder of the world, there were no radio engineers to gloat over its great height in anticipation one day of smothering it in TV aerials. But it was inevitable that the French should have made it the site of their first attempts, and retained it for the Paris service. The line-of-sight which it commands is familiar to almost every tourist, who sooner or later makes the ascent in three sets of hydraulic lifts.

CO-AX FEED

The aerial system is fed via a gas-filled co-axial cable running up the tower from the transmitter room located near its base.

The 819 line system has been in operation since 1950—before that date a transmitter of 441 lines was used. Still earlier transmissions were on about 250 lines and both these early installations are still to be seen gathering d adjacent rooms.

Until a few months ago, the 441 transmitter doubled the program for the system, but a fire on the top of the Eiffel Tower put it out of action, and it is unlikely that it will be used again. This is no tragedy, as only a few sets existed capable of receiving the program.

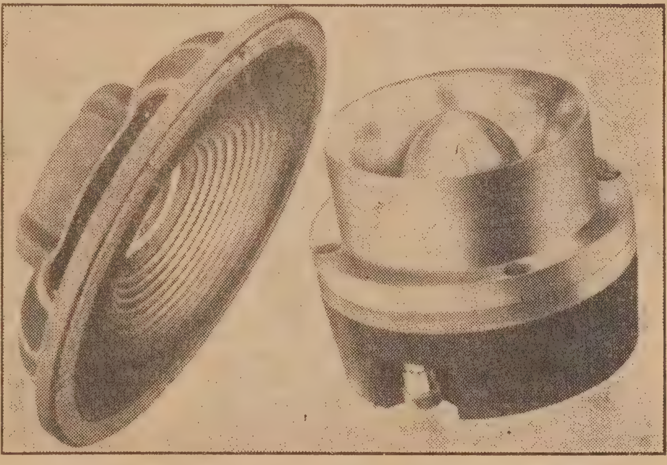
The studios, about half a mile distant from the Eiffel Tower, have been at the same address ever since TV in France began. During the past 12 months or so they have been almost completely remodelled so that most of the studio euqipment is new, and all made in France.

ONE LARGE STUDIO

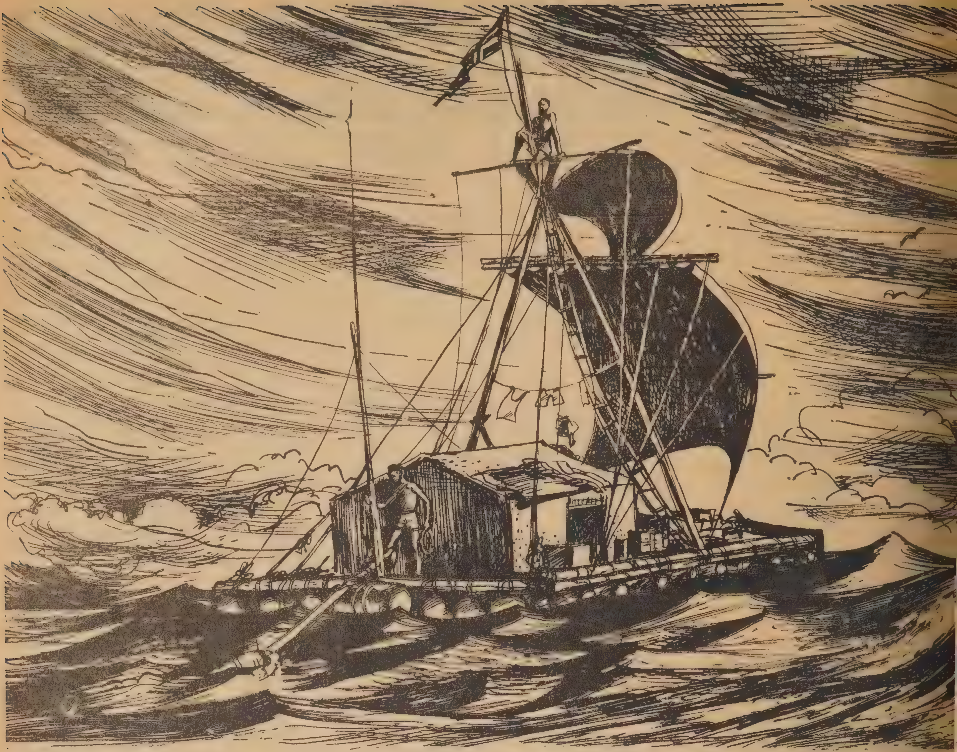
My guides for the occasion were M. Jean Remout, an engineer at the station, and M. Pierre Aujames, Secretaire Delegue de la Federation Nationale des Syndicats des Industries Radioelectriques et Electroniques, a particularly helpful and charming host, despite his formidable title.

At the moment Paris has only one studio of any size, but quite large enough to mount half a dozen sets for a studio play with up to four cameras. Here I watched the rehearsals for a spot show which included a brass band, an English girls' choir, two popular singers, and several interviews, all compered in a manner I have now recognised as just about standard with every TV station in any country.

Later I was able to watch the actual



Two interesting new speakers recently released in the US by J. B. Lansing Inc The D123 cone speaker is a wide range 12" type, which is only 3⅝" deep. It can be used as a single speaker in a good baffle or mounted within the space of a standard 4" stud wall. It has an edge-wound aluminium voice coil. Model O75 is a high frequency "ring radiator", the radiating surface occupying what is effectively the throat of a tapered horn. The design is said to eliminate phasing discrepancies in the HF range.



101 Days at Sea . . .

The expedition by six men on board the "Kon-Tiki" must be one of the most exciting adventures ever undertaken by man.

The 4,300-mile journey on the balsa-wood raft took 101 days. Their only contacts with the world were temperamental short-wave transmitting sets and secret sabotage sets used during the war.

From the outset the wireless operators had a tough job. A sufficiently long aerial was a problem. They attached it to a kite but it was promptly blown into the sea. Then they sent it up on a balloon which burst in the strong sun. Salt water trickled into the battery cases and, finally, their pet parrot ate the aerial.

But, in spite of these difficulties, the "Kon-Tiki" managed to keep in touch with several amateur radio operators, including a Norwegian who lived near Oslo.

This was almost a miracle, considering the short-wave transmitter, with its 13,990 kc. a second, did not send out more than 6 watts — about the strength of a small electric torch.

Improved Techniques. Amateur radio men everywhere have benefited from scientific discoveries which have revolutionised radio techniques.

In SHELL laboratories special resins* have been developed from petroleum and are now extensively used in the manufacture of enamelled wires, insulating materials, and condenser sealers found in radio sets of every type throughout the world.

**Epikote resins*

252/C

ice in a special viewing room
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are several smaller studios for
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all is yet to be constructed.
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DATE

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EXTENDING

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Virtually all the sets are made in France, for it is not a proposition to import sets from countries with different standards. The programs generally are considered good, but whether this means "popular" is open to doubt. All TV and broadcasting in France is operated by the Government, and there is therefore no element of competition.

Very little has been done with FM broadcasting. There are three stations on the air, according to my information, at Paris, Lyons and Strasbourg, but their general quality is not considered very good.

As far as I could ascertain, the French have not shown any interest in color, and do not expect to do so for five or six years.

BRITAIN ACCEPTS COMMERCIAL TV

The introduction of commercial TV in Britain has been a success. The final pattern has not yet emerged, but program contractors are already forecasting budgets balanced ahead of schedule. The BBC has received an overdue shot in the arm from its vigorous competition and viewers are reaping the benefit. All this is very good indeed for the British TV future.

I FLEW from Paris to London on a virtually cloudless morning, one which laid bare the ordered fields of England and France, the streaming wakes of ships in the Channel, and warmed the heart as finally I stepped on English soil. That was some weeks ago, and so far I have been blessed with weather of a similar pattern.

Under it the country has thrown away the threadbare blanket of a bitter winter, and week by week blossomed with a new season.

It is springtime now, the land is flowered, and the air soft with a summer to be. Spring has come quickly to the London gardens where children finger the fairies on Peter Pan's statue at Kensington, and the local swains take the air on the Serpentine. Daffodils spatter the lawns with gold around the ancient walls of York, blossoms whiten the hills along the banks of the Wharfe in the Midlands.

Royal Windsor and the playing fields of Eton are smothered in green beeches, elms, and chestnuts; the village greens are alive with white cricketers; archery clubs set their colored targets in the meadows.

FIELDS OF TRADITION

I know now why Englishmen through the centuries have written their poems and sung their ballads at this time, why the heart aches with the beauty of country lanes alive with color, and even the grey cities leave unforgettable pictures in the inward eye.

I could not help being a little sentimental on my first evening in London, walking across Waterloo Bridge while the sun set redly behind the Houses of Parliament and, high overhead, jet-propelled successors of the famous few scribed their vapor trails in the stratosphere.

To write briefly of what I have seen in England would be something like compiling an index to a dictionary—every day and most evenings have been taken up with a succession of events.

I have walked through factories making receivers, T.V. tubes, loudspeakers, coil kits, transmitters and gramophone records. I have spent hours at T.V. studios, transmitting stations, and taken in a visit to the Harwell Atomic Energy Establishment.

There have been trade fairs and hi-fi exhibitions, England's famous orchestras to be heard in concerts and recording sessions, long talks with engineers, designers and musicians.

And, of course, there has been T.V., upon which the newly established commercial stations have had and are having a profound influence.

EVENING TV

Watching T.V. has taken up most of my free time in the evenings, as against listening to radio. The pioneer operator in both these fields is the B.B.C. and let me say, right now, that it is a mighty organisation. It towers like a colossus over the airways of Europe and is as much a British institution as the towers of Westminster.

On the broadcast band, it was something of a shock to realise that, during the daytime here in London, only two radio programs serve the public with the high-brow. Third program added in the evenings. How listeners in our capital cities would react to a reduction of their choice to this scale is not hard to imagine.

It would be something like wiping out our complete commercial services, for if there is anything more B.B.C. than the B.B.C. itself it is the A.B.C. in Australia. And I don't offer any left-handed compliments with that remark!

At night many European stations are received at good strength in England, and the interference problem on the medium waves has not been exaggerated. Some of them make very good listening, but they aren't much help to the millions of British people who want to hear their own.

3-BAND RECEIVERS

To combat this problem, the B.B.C. is part way through the establishment of an FM network throughout the land. From now on the standard receiver must cover the FM band, the medium band, and the low-frequency band as well, for the long wave service is still operating.

Those who haven't an FM band on their receivers are buying or building thousands of FM converters with which the radio shop windows are well stocked. They go nicely, too, with the hi-fi amplifiers, for which there is a big sale. I don't think there is any doubt that, as time goes on, the bulk of ordinary listening will be carried out on FM, although any possibility of early cessation of the traditional bands seems unlikely.

No doubt the B.B.C. would be happier if they were abandoned, for the cost of supplying so many parallel services is high.

Some day, a like pattern will most certainly be seen in Australia, but surely not until we have solved the major problem of establishing and paying for T.V. industry. I am ever more convinced that this will occupy us for some time to come.

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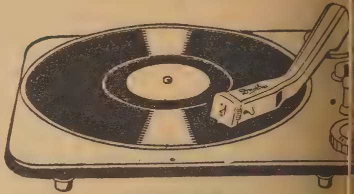

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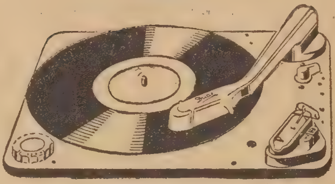

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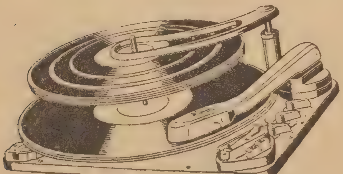
Patented roller for the determination of all record sizes from 6in to 12in . Starting buttons combined with automatic saphire stylus selector "M" or "N". Fully automatic Pickup movement. Automatic locking of the Pickup and Tonearm in the rest position.

DUAL 280 changes automatica records with large centre holes, i junction with the large centre s suppplied with each unit. DUAL range crystal cartridge CDS 2/ incomparable new Pickup for range reproduction and minimum wear.

The two-step filter switch is ide older records.

CHANGER 1003 **incorporates these extra features:—**



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The pause switch makes possible intermissions of from 1 to 4 minutes between records.

Repeat Switch. This makes it possible to listen once again to the record that has just been played.

STOP—When pressing this button, the tone arm immediately returns to its rest position. Locks and switches the entire unit off.

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nificent material, but they are
"popular" than our own. This
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I think, too, it is because
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ED SYSTEM

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APPROACH

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inevitable pressure to ensure
is something interesting all the
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ve the British public reacted
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cial T.V. here is operated by
Independent Television Auth-
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programs to several com-
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use of advertising. There
onsored shows. Programs
ely divorced from the adver-
which are contained in shorts
various features. Actually, it is a bit more complicated than this, but I am skipping the details.

Many feel that these restrictions have imposed a grave handicap on program operators, and even suspect that this was meant to be. Nevertheless, the commercials have gained much ground during their few months of operating, and although it is hard to get an accurate figure assessment through conflicting and slanted reports, they are commanding an audience within their ambit at least compatable with that of the B.B.C.

LOOKING FOR PROFIT

They are, of course, learning their business. Even during my stay, reshuffling of personnel, new and more economical methods of working, a ceaseless probing of the advertising and audience fields, and the development of network operation have changed their cost sheets. Some are already anticipating a profit before very long.

The limited advertising time in each hour is costly, and is sold in spots as small as 5 seconds. Many of these are amusing, punchy things, designed to hit hard at high speed. Of others, the less said the better. Cartoons are freely used but production costs are high.

This sudden release of concentrated activity, following hard on the heels of a program which closes on a quiet note, reminds me at times of Spike Jones at his best, but Australians will find it less difficult to take than British audiences. Singing commercials are very popular, but even these are gradually sinking into the pattern of T.V. existence.

It is almost impossible to estimate how many people can receive the new stations, but older sets are freely fitted with converter units which enable them to be received.

The important thing is whether they can stay the course. I have heard it suggested that eventually commercial T.V. would get into such straits that the B.B.C. would take it over as a second program. I feel that many in the B.B.C. considered this possibility, but I am inclined to believe that if the B.B.C. ever has a second program, it will have to start up its own.

CHANGES IN BBC

Recent events and changes in the B.B.C. indicate that it is not underestimating the challenge it is receiving. There is a re-assessment on all sides. Maybe it is becoming clearer now that, even if the conditions under which the commercials operate must be made more encouraging, they are here to stay. And in fact, these conditions have been modified in recent months, and further concessions may follow.

Not the least forceful argument for their continuation is that, primarily as a result of their competition, the entire TV industry will provide a better, more virile, and more economical service. The initial eight months of commercial TV have taught all concerned many lessons. I feel sure that the next two years will bring many useful changes in the British TV world and most of them will be due to the appearance of new operators in the field.

It is certain that the pessimistic forecasts that commercial TV would bring junk programs and even force the B.B.C. to compete on a lower standard have been wrong. Some people are already

(Continued on Page 119)

METERS AND TEST EQUIPMENT

Manufactured by

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Flush mounting, clear polystyrene case, 4in x 4½in. (All ranges available).

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10, 50, 250, 1000 Volts D.C.
10, 50, 250, 1000 Volts A.C.
R, Rx10, Rx100, Rx1000 ohms and Output volts.

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0-1 M.A., 100 ohm meter (as above) Printed Anodised front panel, with all required holes punched. Metal case, 7in h x 6in w x 3in d. Shunts for M.A. & ohm ranges. Complete building instructions.

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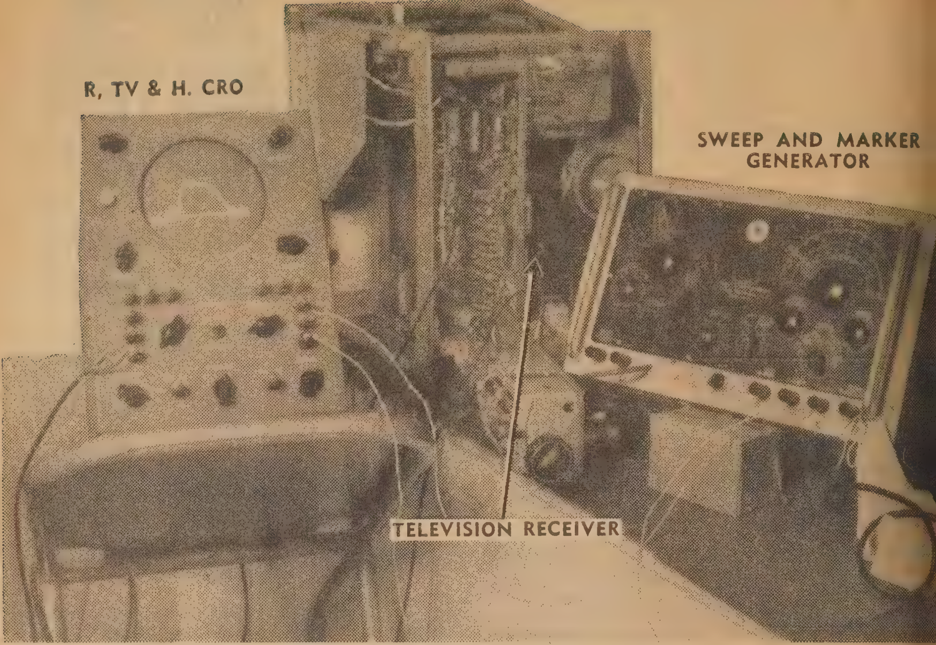

Figure 1. A workshop set-up for the visual alignment of a television receiver. The R, TV & H Wide Band Audio Oscill mentioned in the article, is used in conjunction with the Cossor Model 1323A "Telecheck and Marker Generator". The hap methods frequently used for aligning AM sound receivers are completely out of place around the involved circuitry of line television receiver.

TELEVISION TEST INSTRUMEN

The long-awaited television transmissions will be seen in two Australian cities within the few months, the potential viewers running into millions. Many Radio, TV & Hobbies rea will be concerned with the installation and servicing of receivers, either in a private or a fessional capacity. Of these, many will wish to construct their own receivers both to experience and with the object of saving on cost.

by Maurice Findlay

AS an important background to all this, there is the matter of test equipment. The nature of television receivers is such that the old-time "calibrated screwdriver" approach simply will not work.

To be successful, the television technician must have certain basic items of test equipment and, furthermore, he must be completely familiar with the uses, capabilities and limitations of that equipment.

ADVANTAGES OF HOMEBUILDING

As the months go by we will have a good deal more to say on this subject and will probably describe many of the instruments in a form suitable for duplication by constructors with some, although limited, workshop facilities.

This approach has a dual advantage. First of all, the cost of such equipment is likely to be less than half that of equivalent commercially-produced items and, secondly, in making the equipment you are in an excellent position to understand fully its operation.

In fairness to our readers we must point out that the advantages are gained at the cost of many hours of careful and in many cases skilled workmanship. This is a warning which we suggest you take seriously. Unless you are already a technician with a good backgr radio techniques your chances pleting any one of the several television testing instruments suc is not good.

In any constructional article of able length, there are many poin we must take it for granted reader fully understands, becaus background.

You may argue: Then why describing such equipment, any cause such people will have skill to design their own?

TIME IN RESEARCH

While this is partly true, ther other factor not yet mentioned. our staff may spend weeks, months, in research into the d similar commercial instruments, sion with fellow engineers exp

rticular field, the construction
g of experimental models in
aboratory and the construction
al model, which you will see
otographs and for which we
h the circuit.

ect of such research will not
duce a most elaborate instru-
highly ambitious character-
ve could copy some elaborate
l design if this were the object
et down on paper a record of
esign capable of doing the re-
and, most important of all,
hich no special parts or factory
re required.

hnicians running a business or
ll-time in a radio organisation
e time to do all this, but if a
c design is available, either to
se as a starting point, it is
ferent matter.

METHODS

s no single instrument which
all the requirements of tele-
k. A large percentage of faults
calised almost immediately by
the picture on the screen or
e sound in the speaker. A few
ks with a multimeter and the
pacitor or open circuited re-
he case may be, is located.

loscope is not needed to locate
ctifier when the rectifier gives
a soft blue glow.

instruments will be needed for
ble percentage of non-obvious
without them the time taken
a repair will be multiplied
es. There are plenty of faults
defy solution without resort
struments.

ar observation applies to the
and adjustment of new tele-
ivers. You simply will not get
by attempting to adjust a new
y tuning all circuits for maxi-
onse to the ear, as can some-
one with a simple AM super-
ng on the broadcast band.
some of the desirable instru-
their function would be ap-
at this stage.
the most important single in-
the cathode-ray oscilloscope,
ntend to discuss in more detail
end of this article. In rela-
television receiver, it is some-
the multimeter to the broad-
er.

wn, the oscilloscope can give
picture of the behavior of
horizontal and vertical time-
ators and in conjunction with
nerator, the waveforms from
detector through to the pic-
Those from the video detec-
n the sync. separator to the
can also be traced.

D PERFORMANCE

unctioning of the receiver de-
the waveforms in these sec-
r correctly maintained.
in maintenance of receivers,
ters usually publish typical
n labelled in terms of ampli-
her with the circuit diagram,
o operating voltages and other
rvice data. With these data
struments to observe each
relation to the receiver under
are half-way to finding the

A TYPICAL ALIGNMENT PATTERN

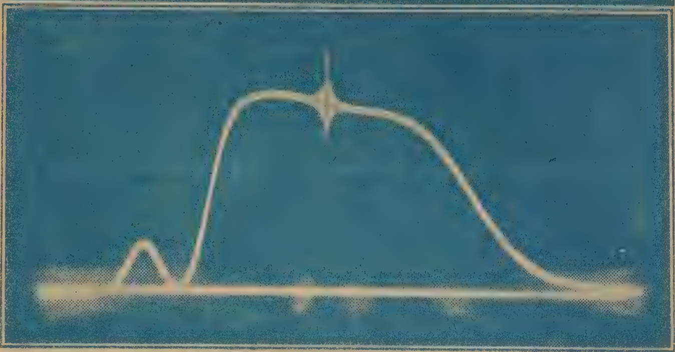

Figure 2. A close-up of the CRO screen in the alignment set-up on the opposite page during the process. Receiver manufacturers publish similar curves relating to various parts of the circuit along with other service information. All details, including the marker "pip" are clearly visible in this unretouched photograph.

The oscilloscope is also very important in connection with the alignment of a television receiver. In the Australian system the significant bandwidth of the receiver is about 7.0 Mc. This is achieved by "stagger" tuning the circuits, particularly those in intermediate frequency section. Individual circuits are tuned to different frequencies in such a way that the overall response of the channel is of the required special shape over the desired band of frequencies.

This can be achieved with an accurate signal generator and an output meter when the individual circuits are adjusted to their correct frequency, according to the data supplied by the designer.

SWEEP GENERATOR

A better mehod is to use the oscilloscope in conjunction with a sweep generator to give a visual display of the response characteristic of the receiver. The sweep generator provides a signal which sweeps over the required range at a regular rate.

For example, the output frequency of the sweep generator may vary between 25 Mc and 35 Mc at 50 cycles per second. The horizontal amplifier of the oscilloscope is interconnected with the sweep generator, so that the spot moves in a horizontal direction proportional to frequency. In effect, any point on the horizontal line represents a particular frequency.

The vertical amplifier of the oscilloscope is connected to the output of the receiver at some suitable point, so that the movement of the spot in a vertical direction depends on the gain of the receiver (Figure 3).

The overall effect is that the response curve of the receiver, ie., the curve of frequency versus amplitude is plotted on the screen of the cathode ray tube. Any variation in the overall response by the adjustment of individual tuned circuits is immediately evident by the change in the pattern and, compared with the alternative of plotting the sum effect of a large number of tuned circuits individually on graph paper, is extremely simple.

It has the advantage over the first method suggested that the overall response can still be made nearly correct, despite the fact that individual tuned circuits, as produced, may not have exactly the Q intended by the designer.

SOUND CHANNEL

In making these adjustments, it is desirable to know the exact frequency that any particular point on the screen represents. For this purpose a calibrated oscillator operating on a single frequency

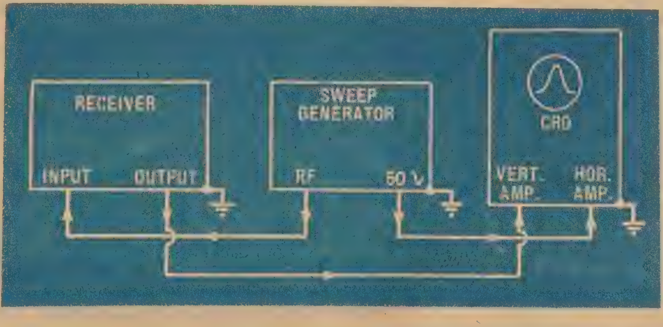

Figure 3: An outline diagram of the connections between receivers, sweep generator and oscilloscope for visual alignment. An alternative is that the sweep generator be controlled from the time-base of the CRO.

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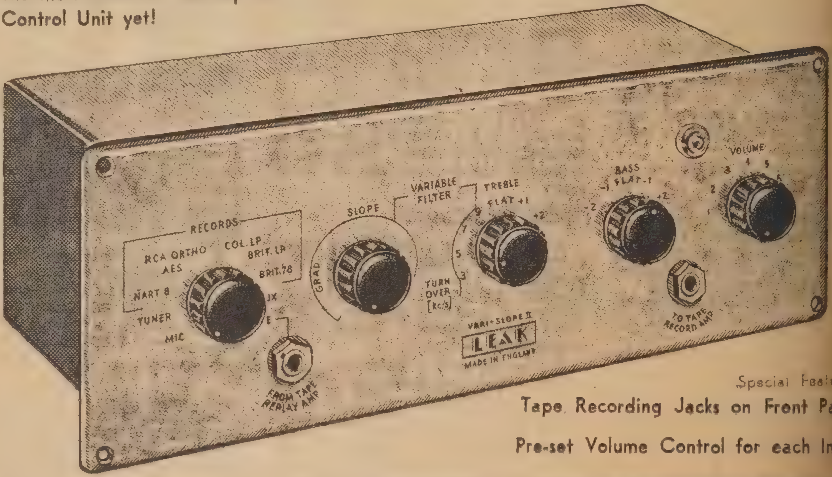
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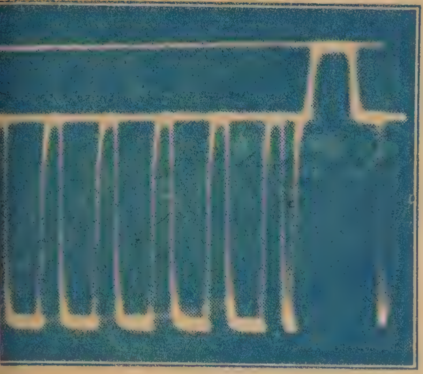

4: Video waveform displayed on the CRO section of the
FWO200M television service instrument. In this case
plifier response extends to 6 Mc. Time-base is at line
frequency.

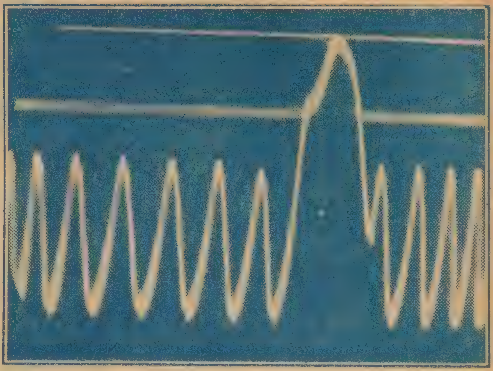

Figure 5: The waveform of Figure 4 reproduced by an oscilloscope with response extending to 300 Kc only. Although there is considerable distortion some useful information is present.

ised. Its output is mixed with
the sweeping oscillator, and it
on the display as a "pip".
frequency of the steady oscil-
varied, the pip moves horizon-
oss the screen and the fre-
f any particular peak or dip in
all response curve can be ac-
determined.
chnique can be applied to the
channel, the front end of the
the vision IF section, and, as
aving time, makes for accurate

LT PROJECT

lition to the oscilloscope and
nerator, other instruments use-
elevision servicing and design
dio frequency signal generator
both the vision and sound inter-
requencies, as well as the re-
gnal frequency channels, and
FM and AM modulation. This
elaborate instrument and prob-
of the most difficult to make
ted facilities.
rn generator is also well worth
This instrument can be made
y simple specification.
ese instruments and such things
resistance voltmeter and simple
ts for checking inductors and
, a television serviceman could
nself as being fairly well equip-

re, of course, variations on the
ts we have mentioned, and we
discuss these in more detail

discussion of the oscilloscope,
eliminaries, we have made no
of a suitable specification for
ment. Many readers will have
'Standard 5in Oscilloscope" al-
cribed, particularly the version
wide band amplifiers described
ril, 1955, issue.
again will have commercial
es which were designed prim-
udio testing and may be won-
w these instruments would fare
sion test set up.
nsidered opinion is that, in
s, existing instruments will be
l.

Instruments designed expressly for television work would include features not to be found in an audio CRO, and people concerned with television receivers will eventually desire a special instrument. But, unless an existing instrument is very much out of date or very elementary, it is likely that you will be able to do many of the necessary tests with it in the meantime.

Let us examine briefly the specifications of the usual audio test oscilloscopes.

The deflection system is almost invariably electrostatic, and the tube usually from about 3 inches to 6 inches in diameter. Except in very simple instruments intended for special test set-ups a vertical (or Y) amplifier will be provided.

The input required to deflect the spot to the edge of the screen varies, but, in round figures, you can expect the majority of instruments to provide a pattern fully occupying the screen with about 0.5 volts rms. This amount of gain allows a usable pattern nearly down to the lowest level found in the majority of audio equipments.

SINGLE ENDED

The simpler instruments with smaller tubes will use a single-ended amplifier which is connected to one deflector plate only of the cathode ray tube, the opposite plate being returned to ground as far as alternating current signals are concerned.

The larger tubes may require a greater voltage for full deflection, and a push-pull system using an opposite pair of deflector plates is desirable. Not only does it enable the higher voltage to be achieved but the frequency response is likely to be improved and the inherent distortion of the deflection system reduced.

The questions of frequency response and output voltage are very much interconnected, as we will see in a later article, but a low to average quality instrument would be substantially flat between about 10 cps and 20Kc with the response extending in either direction as the quality improves.

The best quality "audio" oscilloscopes, of which the instrument described in the April, 1956, issue is an example, go both higher and lower than this.

NEXT MONTH

Methods of achieving the high performance required of TV CRO amplifiers will be discussed in further detail.

OUR TESTS

The improved high frequency response is of the most interest for television work and for our instrument is minus 3 db at about 300Kc. Being designed for audio work, the oscilloscope has a conventional continuously variable gain control, so that the frequency response at the high end is somewhat dependent on the setting of the potentiometer. At the worst setting, the minus 3 db point is at about 200Kc.

With the specific object of determining how this instrument behaves when used for the standard television tests, we took some time off to carry out some of these tests. The result was quite encouraging.

For the standard alignment tests the amplifiers are called upon to handle only a relatively low frequency. A typical frequency would be 50 cps or 100 cps. The wide band audio CRO with its carefully designed linear amplifiers and fine focus is capable of giving a virtually perfect reproduction of the alignment curve.

PHOTOGRAPHS FROM SCREEN

The photographs reproduced here give some indication of this but the line width is greater than in normal use because the intensity control was turned up further for the purposes of the photograph than would be necessary normally.

Obviously from the point of view of the amplifiers a considerably less ambitious instrument would serve the purpose. However, in the matter of size, there is something to be said for a screen

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"The transient response exhibited by the 20W amplifier with the prototype transformer submitted, is very fine indeed. A rise time of 4 uS can be achieved and with suitable adjustment to the feed back phasing capacitor the output wave form of the amplifier can be adjusted for an over-shoot of less than 2% without visible rounding of the square wave 'corners'. As a result of the controlled Q factor at the transformer self resonance ringing is imperceptible on a square wave output of 20W at 5 Kc/s. The square wave performances at this level for repetition rates of 10 and 20 Kc/s are particularly clean; the overshoot being less than 5% and decay minute ring has been affected by half the duration of the flat top at 20 Kc/s, i.e. in some uS. This transient response is the finest we have observed to date and we found it possib to obtain clean square wave outputs of 36W at 50 c/s and 30W at 20 Kc/s which is indicati of the adequate power handling capabilities of this component over the entire audible spectrum

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Primary Leakage Inductance: 8.2mH. (Tested at 5,000 c/s.).
Fundamental Resonance: 120,000 c/s.
Distributed Capacity: 215 pF.
Overall "Q" factor at resonance: 1.06.
Peak response at resonance: (120 K.c.) + 0.5DB.
Frequency response: (at 1W level) plus minus 1DB from 2.8 c/s. to 150,000 c/s.
Power rating: 20 W down to 30 c/s.
Harmonic distortion at 400 c/s: less than 0.5%.
Size: Hermetically sealed case 3½in x 3½in x 4½in high.
Mounting: 4 5/32inW screws at 2.13/16in centres.
Finish: Copper Hamertone lacquer.
Connections: Porcelain seal terminals in base.
Output valves: Mullard EL-34.
H. T. Supply: 440 Volts.

* These transformers are supplied with four equ secondaries, all of which must be connected. Norm secondary impedances are 3.75 ohms, which can interconnected for 15 ohms. The secondary impedan varies as the square of the number of series sectio Thus, two 3.75 ohm sections in series is 15 ohms—thr sections in series is 33.6 ohms and all four windings series is 60 ohm. All windings in parallel is 3.75 ohn Other secondary impedances are available to order b must be calculated according to the foregoing explanatio

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f 4 inches or greater, for the observing details of the curve. emarks apply to all visual methods where the output of ier applied to the oscilloscope , whether the rectifier be the tor, the FM discriminator or ectifier probe attached to the

be possible to connect the in- amplifier directly into the mplifier chain when the dis- be a double-sided pattern me shape as the rectified pat- disadvantage is that the oscil- plifiers are called upon to IF and if it is desired to ob- ehaviour of the earlier stages a detector probe would be advantage.

any, instruments likely to be rvice workshops have either ain or a sufficiently wide fre- onse to handle signals in the directly.

) FRAME

ainder of the tests in the re- arried out, in the main, with cope time-base set at either 15,625 cps being the frame equencies respectively. As ve, simple submultiples such and 7812.5 cps allow two cycles to be observed on each he time-base, which some- a clearer indication of the f the circuit.

e can be saved if the two ient time base frequency set- orded on the panel in such a y can easily be repeated. It worth while in a special TV including a couple of extra ions, so that you can select ies with a minimum of ad-

io oscilloscopes, the conven- n to employ small thyratrons oscillators. The principle of ill be familiar to most, but pacitor is charged through a a high tension source until reaches the breakdown volt- yratron.

int the capacitor is suddenly after which the charging nces again.

e at which the discharge oc- varied by altering the bias on grid of the thyratron, and, if eriod of the resistor-capaci- a little longer than that of non to be observed, a small is signal fed into the control ve to provide exact synchro-

.VE TIME BASE

used extensively in the past, s simplicity, there has been cently to employ hard valve cillators in place of the h time taken for the gas to ts the upper frequency to Kc and 150 Kc, depending f tube and, at high frequen- lency for the breakdown to htly different voltages in a on gives rise to a "jitter" in naking it impossible to dis- line.

ears a number of time-base ploying high vacuum valves veloped, and, in many cases, s over the gas triode os- e expense of slightly more itry.

HIGH IMPEDANCE PROBE CIRCUIT

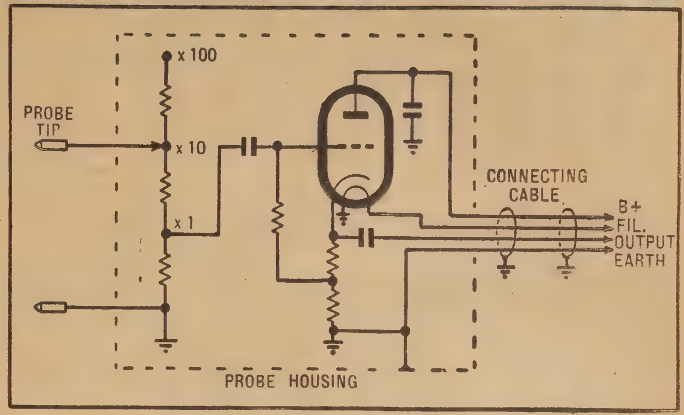

Figure 6: Outline circuit of a cathode follower probe. Advantages of the probe are that it has a high input impedance, low output impedance and its use does not encourage unwanted coupling between the sections of the receiver being tested and other circuits.

Some of these oscillators have a high output and can actually be fed direct to the horizontal plates of the cathode ray tube. However, the low output voltage of the usual thyratrons in audio instruments usually makes it necessary to include a horizontal amplifier. In general, the frequency response and output voltage requirements are similar to those of the corresponding vertical amplifier with the exception that the overall gain may not need to be as high, and one stage may be omitted.

So much for existing audio oscilloscopes. The question now arises as to the specifications of an instrument designed especially for television servicing. Here the old question of cost versus performance comes up.

THE ULTIMATE

Most people would prefer a car with an automatic transmission and power steering, but, for the most part, have to put up with a somewhat less ambitious vehicle.

The most obvious characteristic is probably screen size. While you could probably do quite well peering into a 2-inch diameter screen, we would suggest that a 3-inch screen is about the smallest useful size for an instrument in regular use.

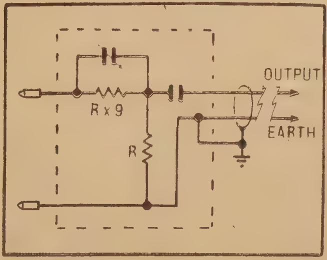

Figure 7: Less expensive and smaller than the probe of Figure 6, this probe provides an increase in input impedance at the expense of gain.

The 4-inch screen offers an excellent compromise between size, portability and cost, with larger screens to be preferred, where size and cost are not so important. Our own choice may well be influenced by the availability of the 5in 5BP1 locally through disposals dealers at a fraction of the cost through the regular trade channels.

The next characteristic for consideration is the frequency response of the vertical amplifier. It is not possible to give a clear statement of the requirement in this direction. The equivalent, in oscilloscopes, to our fluid-drive car, would have a direct-coupled amplifier, and therefore be able to respond to the lowest frequencies. At the high frequency end of the band the response will be level to 5 Mc or 6 Mc.

However, it is quite difficult to make a stable high-gain direct-coupled amplifier and, when 200 or 300 volts have to be developed across a stray capacitance of, say, 20 pf at 6 Mc, some special and expensive techniques have to be employed.

ACCEPTABLE PERFORMANCE

While very nice for specialised laboratory work, performance of this order is not essential for TV servicing.

What then is the minimum acceptable performance?

At the low frequency end of the band the response can fairly easily be extended low enough without DC coupling, and this is usually not too serious a worry. The usual resistance/capacitance coupling networks can therefore be used with a substantial saving in final cost.

At the high frequency end, various authorities will express different opinions. However, it is generally considered that the minimum worthwhile instrument for investigation in video and time-base circuits of a receiver would extend to 100 Kc with negligible attenuation. A response up to 1 Mc offers definite and easily-appreciated advantages, while, to obtain an undistorted pattern, the band would need to be extended to 6 Mc.

In order to give you an idea of what

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happens when the response is limited we took photographs (Figures 4 and 5) of the trace produced by a pattern generator on the R, TV and H CRO and on another instrument which extends to 6 Mc.

The time-base was adjusted to half line frequency and the horizontal gain advanced so that one line occupied the entire screen. The pattern generator was set to give vertical black bars.

6MC STANDARD

Using the pattern from the 6 Mc CRO as a standard (Figure 4) the distortion introduced by the limited frequency response of the R, TV and H Wide-Band Audio CRO is clearly shown.

The limited response gives the impression that the bar pattern is not fully modulated, i.e., the black bars extend only into the grey region and for the same reason the sharp corners of the original pattern have been removed. Even so, an experienced serviceman would be able to make good use of the pattern for the purposes of fault diagnosis.

Furthermore, this particular waveform was chosen for the comparison test because it is one of the most difficult to reproduce from the point of view of the oscilloscope.

Mention has already been made of the requirements of the time-base oscillator. Since the additional components required are few, a continuously variable time-base is usually provided and the response may extend up to frequencies considerably higher than 7812.5 or 15,625 cps, enabling the instrument to be used to trace spurious high-frequency waveforms and to be used for purposes other than television testing.

The time-base may have sufficient output to be fed directly into the deflector plates of the cathode-ray tube, in which case the horizontal amplifier may be omitted, but only provided the sweep generator used has facilities for accepting the oscilloscope time-base waveform to control the frequency range swept.

The sweep frequency may alternatively be controlled from the power mains, in which case a terminal intended to be connected to the horizontal amplifier of the CRO is usually provided. This will probably be connected to a filament winding through a capacitor and provide about 6 volts into a high impedance load.

To allow for some expansion and different sweep generator types, it would be good practice to provide an amplifier to give full horizontal deflection with about 1 volt in.

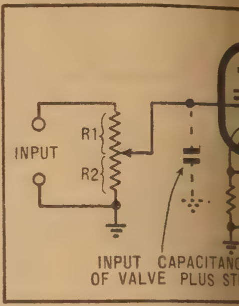
LOADING

One factor we have not yet considered is the effect of the instrument on the receiver under test. The test points for the published waveforms are invariably chosen so that the CRO will disturb the circuit as little as possible, but obviously there is everything to be gained by designing the instrument for minimum loading.

In the better commercial instruments, extensive use is made of the cathode follower, which exhibits the properties of an impedance transformer. The input impedance is high and therefore the loading on the previous stage low. At the same time, output impedance is low and the output voltage little affected by additional loading (resistive or reactive) as from, say, the capacitance of a connecting cable.

The cathode follower is sometimes mounted immediately behind the input terminal for the vertical amplifier and fed into a low impedance attenu
the double advantage that the
pedance is high and the output i
low enough to be fed into a
quency selective low resistanc
ator.

Another possibility is that th
follower be installed in a prob

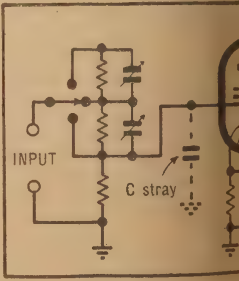


Due to stray and input cap
of valve, this type of atten
frequency selective. Worst pos
high frequency loss is when R
R2.

6). The lead between the valve
the circuit under test can then
very short and, provided suit
stants are chosen, the shunting
the coupling cable to the main i
is rendered unimportant.

It is usually difficult to desig
ode follower with suitable char
and able to accept an input gre
about 10 volts. A possible solut
be to build a times 10 and a
attenuator into the probe.

The input impedance of the i
can be increased at the expense
the use of a probe which consi
tially of a series resistor, moun
probe tip, with a small parall
tor (Figure 7). The ratio of
resistance of the CRO proper to



A stepped attenuator permi
factory compensation for stray a
capacitance. Adjustable trimm
often convenient.

resistance may conveniently be
to 10.

So that the probe itself doe
hibit frequency discriminating
istics, the effective shunt capa
the input resistor must be 1/9
input capacitance, including th
connecting cable. For this r
effective input capacitance is no
by a factor of 10, as would app
it is always necessary to have

(Continued on Page

E SERVICEMAN TALKS ABOUT TV

of a change this month I am putting aside my usual batch of stories—after all they p—and propose instead to say something more about television. This is a subject which ming more important as the weeks slip by and a recent report which came my way contains much interesting material.

E that in concentrating on ject I am favoring to some readers living in the Sydney rne greater suburban areas. other States and country his is still mainly theory and rather less urgent. Neverthe-ly a matter of time, and in ity areas at least, this time so long.

er of fact you fellows have f an advantage over those , who will be plunged into it in the next months; you to watch our progress and our experience from a com-afe distance; you will be n to learn, yet far enough id most of the petty worries ces. Take my tip and make it.

TOPIC

is certain: wherever I go hear nothing else. When-ervicemen meet, television lence over everything else. ne seems to be asking the ons and having the same hard will it be — really? ugh technical knowledge? ent will I need — and what How long does a typical ake? These, and a dozen hem, are typical.

one else, I am trying my eep pace with the rapidly ne and to be ready when it o, have asked these same was, therefore, with con-rest that I received a recent om one of our large radio n organisations — Philips lustries Pty. Ltd. — in the television progress report, t to answer many of these the light of overseas experi-

it, I was struck by the rmation it contained and it was well worth passing low slaves. I have therefore Editor to let me put aside ries of faults and failures, instead some extracts from

E SITUATION

urse, an attempt to present g' situation; something on dividual can base his own suit his own needs, rather nd fast plan to be regarded by everyone contemplating icing.

ing, the fact that I have ecific pieces of equipment brand) from the report n that I necessarily regard est or only pieces of equip-uld use. Quite frankly, I ake up my own mind how much equipment I will need to buy, how much I can make, what kind I will buy, and what I can't afford anyway.

Like myself you will have your own ideas, and your own preferences for a particular make. The following need not necessarily change them. But the instruments quoted are typical of what the well-equipped serviceman will need.

After a discussion of television prospects, sales policies, and similar matters, the report turns its attention to the question of service. Dealing first with indoor servicing it says:

"Apart from installation work, TV dealers will need to provide routine maintenance service for their customers. For a dealer installing up to 250 sets a year a good service workshop will require two competent technicians to handle installation, pre-sales testing and routine maintenance. One extra serviceman will be required for each additional 300 sets sold.

"A TV serviceman overseas is paid 25 pc more than a qualified radio mechanic. This will give you an idea of the rough basic rates of pay you may be faced with.

"Usually two men are necessary for home installation. Average installation time (including travel) is two hours per set when aerial facilities are available. The newly-installed set is then added to the maintenance list for regular attention.

SERVICE CALLS

"Maintenance calls may be classified as:

(a) **Nuisance Calls:** Usually due to customer's lack of knowledge of the set and the effects of external interference, e.g., refrigerators, cars, vacuum cleaners, etc.

(b) **Real Calls:** These consist of breakdowns in valves, components, picture tubes, etc.

"Nuisance calls will be most frequent until the public has become familiar with TV. Overseas, average service calls on each set number approximately five annually. The English charge for outside service in metropolitan areas is approximately 30/- (including transport). American charge is approximately six dollars per hour excluding parts.

"Average repair time is approximately two hours but experienced TV servicemen may reduce the time to one hour. At first, costs and repair times will be much higher than indicated above.

"When selling and servicing 250 sets a year you will require:—

"a. Two work benches and two workshop trolleys in 300 square feet of floor space.

"b. An extra 400-500 square feet of space for storage of defective sets, repaired sets, parts, picture tubes, etc. Figures do not include storage space for new stock.

"Starting to think of TV service problems and all they entail, one might well become really concerned, but anticipation is worse than realisation, and you will find many of your fears groundless. Servicemen gain experience rapidly and not every service call means difficulties. Many faults are elementary disturbances or are due to customer's ignorance of his set.

"Faults are problems only when you have insufficient instruments. With right instruments, locating and correcting obscure faults becomes routine. Without adequate equipment it's often impossible to diagnose the trouble. Armed with a full range of instruments you will have no worries. Energy and application achieve success in servicing.

PHILIPS' SUGGESTIONS

"(a) Pattern Generator (Philips GM-2891). One only needed. It provides stationary patterns of vertical, horizontal or cross bars, with frequency-modulated tone. It is used as a substitute for television transmitters, which will probably **not** be on the air during the greater part of time when servicing will be required.

"The instrument provides a stationary pattern where a moving scene is unsuitable for function-testing. The GM28191 is small and light enough to be easily portable and may be carried in the service van. Price £110/2/6 (plus sales tax).

"(b) Two Vacuum Tube Voltmeters with HT Probes to handle 15 to 20 Kv. HT supply to the picture tube. Philips GM7635/01 costs £65 (plus sales tax). Probe, £16/19/- (plus tax).

"(c) One AM/FM Signal Generator to align high frequency and intermediate circuits. One between two benches required. Philips GM2889 (including marker oscillator for internal calibration of sweep generator), £174/12/- (plus tax).

"(d) Two Cathode Ray Oscilloscopes of sufficient bandwith to handle (without distortion) fast rising pulse wave forms on video circuits. Philips GM5659 is £155/15/- (plus tax). One required per bench.

COMPONENT CHECKS

"(e) One Universal Measuring Bridge: (Philips GM4144/01) provides rapid and simple testing of components. For example, when aligning the receiver for adequate band pass, trouble experienced may be tracked to out-of-tolerance damping resistor across an intermediate transformer. Practice shows that accurate determining of the values involved requires a bridge. Philips GM4144/01, £53/15/- (plus tax).

"(f) One RC Generator. (Philips GM-2317. Tests audio response. Frequency characteristic of audio channels of TV receiver is greater than that found normally in AM receivers. One unit re-

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between two benches. £92/12/-
ales tax).
ed on present prices and with sales
2½ pc the investment in the above
of instruments amounts to approxi-
£1020.

itional costs to be considered: Two
benches with suitable shelving
awers, £60 each. Two suitable
, £20 each. (Prices estimated by
dent tradesmen.) Therefore, cost
benches and two trolleys would
oximately £160. We suggest that
ched 'blueprint' for making trol-
benches be discussed with com-
radesmen when you are ready to

addition, at least one service
especially equipped for TV, is
. Estimated cost: £1600 com-
Grand total cost estimated:
"

r frightening, isn't it? But take
here are other ways of looking
situation. For a start, it is most
hat one's existing service truck
e to double for TV installation
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ents.

ECONOMIES

the workshop some economies
possible. Note that some of
s are duplicated and, while this
etely justified, if there is enough
keep them fully occupied most
me, it might be as well to wait
sure that such is the case. In
time, one of each would prob-
ice.

items may already be on hand.
cuum tube voltmeters designed
years will only require a high
robe to make them suitable for
. Provided they can be spared
ventional radio work there is no
hy they cannot be used.

ly many fellows already possess
sal measuring bridge of some
l, although extremely valuable
uired, it is not the sort of thing
continuous use all day.

have a CRO it is unlikely that
rve for TV in its present con-
it it may be possible to modify
e it suitable. The main require-
s far as I can determine at
re horizontal amplifiers having
ately at least a 1 Mc band-
reproduce the "square" shape
orizontal synchronising pulses)
ne base capable of linear per-
up to the line frequency (ap-
ly 15 Kc).

r your present CRO is capable
modified is something you will
etermine for yourself, but it is
orth following up.

OUR OWN?

even be possible to make some
st gear yourself. The exact
s not perfectly clear at the
ut I understand that some over-
ns for certain items are rela-
ple and well within the scope
erage chap to build for him-
ssuming he has the time, of

other hand the idea can be
far, and endeavoring to make
makeshift equipment can be
unsatisfactory, resulting in
rges to the customer than are
service charges may well be

high enough anyway) and, even worse, failure to give the customer the service to which he is entitled.

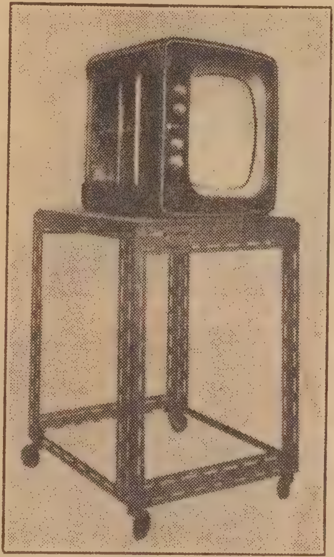
From inside service we go to outside or "field" servicing. The report continues:—

"Greater importance is assumed by TV outside service, than is the case with radio, for the following reasons:—

(a) Visual impact is greater than aural. With TV breakdowns, the client feels its absence far more than radio. Speedy repairs are essential to retain goodwill.

(b) The client has a high equity in a valuable piece of equipment, which he doesn't want out of his sight. He is unwilling to take the risk of cabinet damage.

(c) Field service is essential to ascertain whether the complaint is due to local conditions or otherwise, i.e., poor customer instruction/operation, faulty aerial connections, local interference, etc.



Philips suggest this as a typical trolley for the handling of TV receivers. It may be made from wood or one of the pre-punched types of metal strip, such as "Loxangle" or "Dexion". At least two of these will be required.

(d) Almost without exception, customers are unwilling to bring their TV sets to workshops for repair.

"Overseas, 85 pc of service is carried out in the client's home. As local technicians gain experience, only a low percentage of sets need be returned to the workshop.

"However, in some cases the serviceman must decide whether it is more desirable to

A. Deprive the customer of his set for a few days, with the consequent risk of transport damage, or

B. Spend more time than he normally would in the client's home, and risk 'loss of face' on his ability.

"For this reason a time limit should be set for house calls. Generally speaking, repairs which cannot be completed within an hour should not be done in the client's home, unless warranted by special circumstances. Remember, that repairs on the spot reduce costs for both you and your customers.

"However, the 'tough dogs' or lengthy repairs will have to be done in the workshop. The sets should be returned to your customer within a few days.

"If the Service Technician is to carry out the maximum number of repairs in the field, he must have a certain stock and equipment on hand. This should be permanently assigned to the outside man and his vehicle. He assumes responsibility for his gear, and always knows his position regarding replacement parts and instrument condition. If equipment is handled by different people and transferred in and out of vehicles, control becomes difficult.

FIELD EQUIPMENT

"Equipment suggested for field repairs to TV Receivers (aerial installation excluded):

General:

Service data for each type of receiver.

Full range of spare valves and crystal diodes for each type of set handled, including at least one picture tube.

Spare parts (resistors, condensers, coils, output transformers, potentiometers, tube sockets, etc).

Roll of transmission line.

Handtools (screwdrivers, pliers, cutters, soldering iron, etc).

Extension cords, plugs, sockets.

Safety goggles.

Protective gloves.

Mirror (preferably on adjustable stand).

Electric torch.

Drop cloths.

Dusting brushes.

Lubricants.

Adhesives.

Test Equipment:

Bias Box

Multimeter, preferably 20,000 Ohm/volt.

Pattern Generator:

Universal Measuring Bridge.

Vacuum Tube Voltmeter.

High Voltage Probe for above.

"Additionally, a Field Strength Meter is a useful accessory, particularly for dealers operating in or close to fringe area conditions. It enables the Serviceman to determine, during transmission times, if an aerial of high gain is necessary.

"He can also check if the aerial is correctly oriented.

"For the dealer who undertakes his own installations it is a very desirable piece of equipment, as also is a light extension ladder. With the equipment listed, the technician can trace and repair the majority of defects encountered.

SAFETY FIRST

"Safety goggles and gloves are essential when handling picture tubes. The incidence of implosion is not high, but when it does occur the results can be disastrous.

"The Mirror is to be placed in front of the receiver while various rear adjustments, such as focus, centring, are carried out.

"Drop Cloths, which should be kept clean, are to be placed beneath tool kits and chassis, when it has to be removed from the cabinet.

"The Bias Box is used for trouble shooting defective AGC circuits.

(Continued on page 43)

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performance of some valves in circuits is rather critical. In to the replacement valves car- is a good idea to have a suitably set of test valves, which may be r substitution tests. The advant- supplying replacement valves in artons is important in customer s.

he technician gains more experi- e will be able to do more and pairs on the spot. Regular 'Ex- e sessions' of the whole tech- aff will help to achieve this ge.

technician should carry neat tool ts kits in addition to his instru- The latter should be suitably ed in mounted receptacles inside to prevent damage from mech- shocks in transit. Protective (felt cloth, padded covers, or should also be carried to pre- amage to customer's cabinets ts have to be brought back to kshop."

E DUTY

hat, I think, is a very interesting of things to come. Whether some inside equipment will have to for outside work for a while is to decide and will, once again, on the total amount of work to led.

eater immediate interest was the t that 85 pc of repairs are made customer's home. Perhaps it's hinking, but I can't help kidding hat if this percentage of jobs one in a reasonable time, with- workshop facilities, then maybe ing to be so bad after all.

other hand they may be trying it to us gently that this is the of efficiency we have to

brings us quite naturally to the of technical training. How is Read what Philips have to say heading: Qualifications for TV ns.

the outset of TV in Australia, and experienced servicemen will However, men with at least experience and above average he radio service field, provide potential. With little additional hey can quickly learn to handle problems. Men with amateur ground are particularly adapt-

ian who boasts of a technical schooling, but who lacks radio experience should be avoided. ke far longer to become useful ctive than the radio man with- perience. Similarly men with ning are generally out of their ne TV servicing business.

LATION

installation man need not neces- qualified technical man. As e willing to climb roofs and antennas, younger men are to be ed In a crew of two men, one classified an installation man, and s his helper. The helper needs moderate training.

installation man, in addition to training, should be intelligent and ef. A few day's practice should for him to learn how to se efficiently. His lack of in- technical training can be more ensated for by an understanding of customer psychology, and by sales-mindedness."

If you are inclined to think this lets you down lightly, take particular note of that word "potential". In other words a person with the experience described is merely regarded as having sufficient basic training and experience to justify his being trained for TV. As I see it, it will still call for a lot of hard work on his part, both in basic TV theory now and ability to learn from experience when the real thing is encountered.

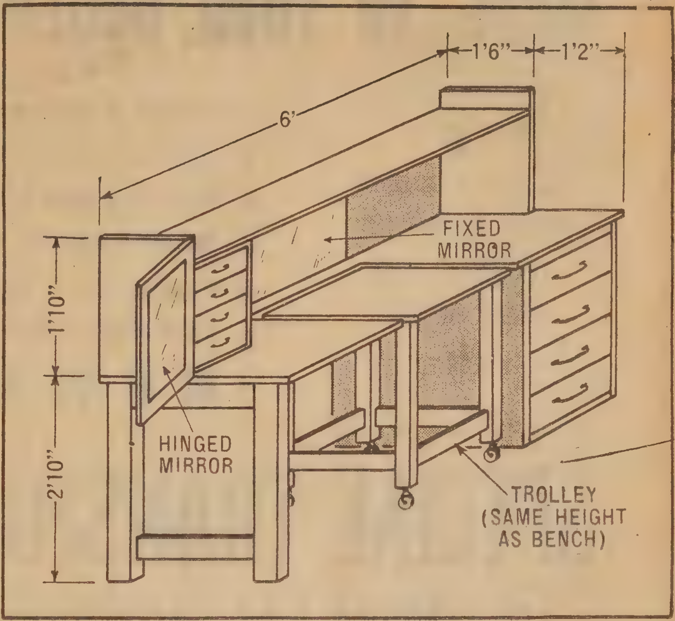
SPECIAL AERIAL

Probably the most frequent statement I have thrust at me regarding television is: "Of course, you need a special aerial for TV, don't you," in a manner suggesting that this is something regarding which all designers should hang their heads in shame. Some even go further, adding, "Still, I suppose they'll overcome that as they learn more about it." This approach suggests that television sets are at present in a stage comparable with that of the early two and three valve sets with their inherently poor gain.

Personally I prefer to look at it a little differently. Rather than thinking in terms of "having" to use a special aerial I like to think we are fortunate in "being able" to use a special aerial; an aerial which, if not always truly resonant, is at least much more nearly so than is possible on the broadcast band. In difficult fringe area locations a truly resonant aerial for each band makes a vast difference to the chances of securing a usable picture.

But I'm afraid I get awful sick of trying to explain all this to non-technical types, particularly when their outlook is generally biased to start with. It was with considerable appreciation, therefore, that I read the following section of the report. I commend it as an excellent summary of the aerial situation.

A DESIGN FOR A TV BENCH



This design for a TV service bench is based on several suggestions and ideas which we have encountered lately. Note the trolley which matches the height of the bench and becomes part of it when in place. The mirrors are essential for checking images while working behind the chassis.

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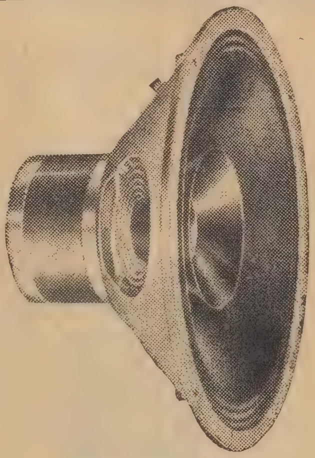

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critical you are the better we like it. Read
specifications, and your eyes will tell
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and your ear will prove it.*

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purchasing a TV receiver the
estion assumes an important
an, interference-free reception
ssible to a small extent with a
rial. Unfortunately, there are
as about the necessary magni-
costs of an outside TV aerial.

pposed views are predominant.
e is the idea that a TV aerial
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fficient, as is the case with FM
roadcasting.

IDEA

ther idea is that, if an aerial
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cases.

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ntained in a TV transmission
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e far greater than necessary
receiver.

bvious that at a certain dis-
the transmitter, and depend-
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e can only be obtained with an
aerial. Future technical ad-
l not make it possible to in-
sensitivity of modern TV
such an extent as to dispense
al aerials.

TV sets have already reached
a sensitivity which approaches
tical limits. The remaining
will be of no importance.

ge content of information in
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ency waves behave similarly to
. The propagation of TV sig-
approximately optical laws.
good reception is obtainable
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g aerial (50 to 100 miles, de-
height of transmitting aerial).

PICTURES

objects, especially if they con-
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ngle equals reflected angle).
interfering reflections can be
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ildings of reinforced concrete,
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a reflection appears at the
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on is that they will perform
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evision broadcast station.

rform properly, an aerial must
quirements. The first is that
a strong enough signal, and
that it provides a clean signal.
eceiver is near the television
ation, indoor aerials usually
ong enough signal; however,
d up inside apartment build-
equently marred by ghosts.

Furthermore, indoor aerials can be expected to pick up a great deal of electrical interference generated nearby.

"In short, an indoor aerial rarely provides results which are equal to those obtained by an outdoor aerial. The indoor aerial must be considered as a second-best choice made necessary because of practical restrictions.

"For outdoor aerials a folded dipole is mostly used as driven element. Additional rods are placed in front or behind the dipole when necessary for particular application. These rods, normally up to nine per combination, are called 'reflectors' if placed behind the dipole, or 'directors' if placed in front of it.

"The simplest form of a TV aerial consists of a dipole with reflector. The magnitude of aerial voltage depends on the number of aerial elements, and on the height of the aerial. The influence of height on aerial voltage is quite considerable.

TRY UNDER ROOF

"If the signal from an aerial at window level is weak, try mounting under the roof. Cost will increase because of longer feed cable, more insulators, and added labor. If satisfactory, however, the considerable expense of mast and guying is avoided. If still higher gain is necessary, an aerial with additional directors may be used, or you may be forced to a roof mounting mast.

"In fringe areas, where even higher gain is required, aerial combinations may have to be stacked. For this purpose, 2 to 4 similar aerial combinations are mounted on top of each other on a mast. Naturally the price increases proportionately.

"For the purpose of tuning out reflections, the directional properties of each dipole can be considerably increased by employing 8 to 10 directors. This limits the angle of aperture to 30 to 40 degrees. Only signals which fall into this narrow segment are effective. Signals from other directions (reflections) will be strongly suppressed.

"By rotating the aerial the optimum direction for tuning out ghosts can be found while watching the screen. These narrow beam aerials are called Yagi aerials.

"In large blocks of flats, the problem of a community aerial arises. Stacked arrays are often used, in conjunction with a booster amplifier, to supply 8, 10 or more receivers with a TV signal.

BUILT-IN AERIALS

"Many TV receivers have a built-in aerial which can supply an adequate signal in the vicinity of the transmitter. However, strong reflections cannot be tuned out with the built-in aerial. Metallic objects (aluminium venetian blinds, and, to a lesser degree, wooden venetian blinds painted with a highly metallic finish) will disturb the picture considerably. A good outside aerial at least at window height is required under such conditions.

"Reception with a built-in aerial inside a reinforced concrete building is almost impossible.

"The aerial and its installation cost will be additional to the cost of the receiver. Firm figures cannot be quoted at present, but the limits should be between £12 and £25 for domestic installations. It must be stressed that apart from the quality of the aerial, the quality of the installation is most important if optimum results are to be obtained."

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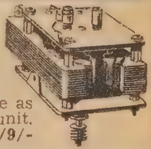

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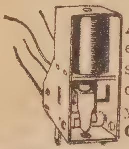

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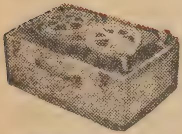

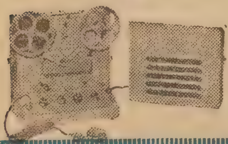

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are only two small points I e to add to the above. First, ople are inclined to take the ight" statement rather too liter- any amateur knows, one doesn't e able to see the transmitting h a pair of binoculars before is possible; on the contrary, als often appear in the most ooking places.

s reason it is likely that some may turn out to be rather better would think at first glance; the the transmitter is not directly es not automatically rule them

T PROBLEM?

other hand—and as already ut—the fact that signals can d does not automatically mean ory service. Reflections in par- k like being our greatest head- hielded areas.

her point arises out of some made by a representative of one cal TV aerial manufacturers. to him, overseas practice when n aerial is to locate it in the rable position from a purely l point of view. In other the house has a chimney, put chimney. If it has a gable roof, to the gable.

s that in most cases this ap- justified by the simple fact that perfectly satisfactory results. viously poor localities or locali- experience has shown to be s it necessary to go crawling e roof with a field strength locate the best position, which ppen to be a mechanically ne.

at is his story, anyway, and I, incerely hope that he is right. uld stand heights.

Light Amplifier

light amplifying device which capable of increasing bright- he order of 40,000 times is g manufactured by the Ben- any under the trade name o'.

w device consists of a closed system coupled directly to or viewing unit which in- kinescope or TV display tube e type as used in home sets. ndard TV practice, however, to obtain better resolution, n uses 1629 lines instead of ican standard of 525 lines. tor unit consists of a stand- ickup tube together with an optical lens.

Press preview of this device h room lighting except the exit s extinguished and the subject ront of the camera. Although was not visible to te naked as an outline, all details of d dress became clearly dis- e on the monitor screens with the Lumicon.

the most useful applications micon is in the medical field larly in connection with X- sis and radiation therapy. Be- he devices ability to amplify gy, doctors can examine ing a very low level of X- cing radiation hazards to d doctors alike.

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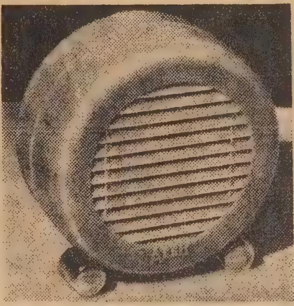

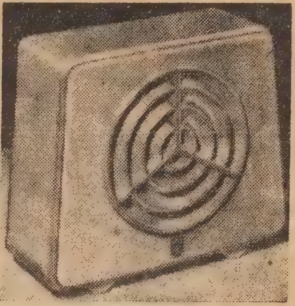

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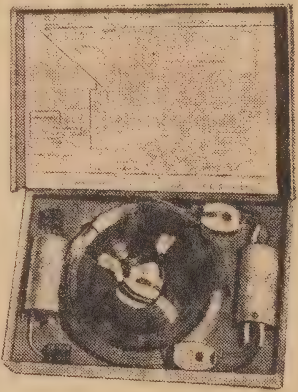

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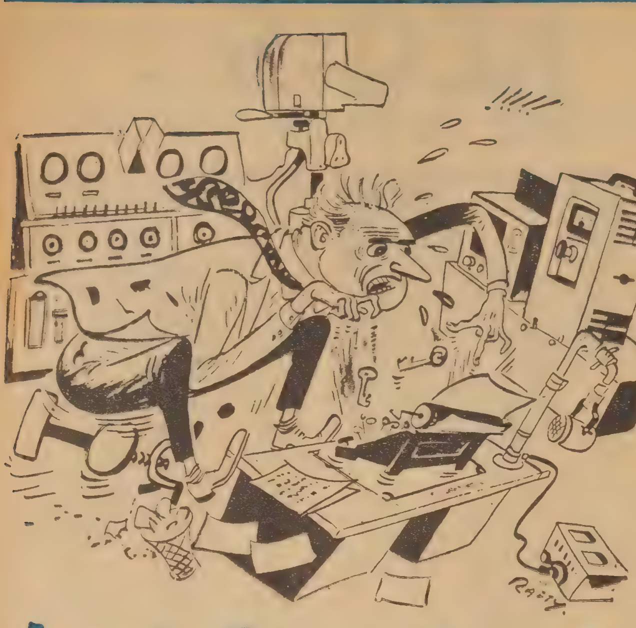

Let's Buy An Argume

F.M., whose letter appears opposite, is the kind of man who makes arguments possib he believes a thing, he says it straight out, without mincing words. He calls a spade a s if he sees a mattock lying around, and doesn't know the difference, he calls that a spade Read his letter and you'll see what I mean!

by Neville Williams

IN short, F.M. doesn't like the resistor values we've been using lately.

He's "exasperated by the sheer, ridiculous pedantry of it all".

He cannot stand to see a one-time practical man's paper like Wireless Weekly-Radio-TV-cum-Hobbies aping laboratory practice by showing "measured" rather than purchaseable resistor values.

(Just wait till he sees a .047mfd bypass on the AVC line!)

He makes a lovely crack about "the power behind the throne".

With the Editor away overseas, those sound very much like fightin' words. (Fortunately I wear glasses).

NO INTIMIDATION!

And finally, there's F.M.'s determination not to be put off or intimidated. "Don't attempt," he says, "to bull-doze me into agreeing with you by technical mumbo-jumbo."

Well, that's lovely, that is! It makes it really hard. It means that we have to advance a logical reason for our exasperating pedantry.

Ah, well. I guess we'd better make a start. You see, it's a long, long story:

Once upon a time, many years ago, some ingenuous men decided to seek their fortune making radio resistors. But it wasn't as simple as they'd expected. Try as they might, they couldn't make their resistors accurate.

Chemicals varied, wires varied, machines varied, the weather varied — and so did their resistors! They used to worry and fret and sit sleepless in their offices all day.

At first they were conscientious and threw away all the wrong ones. But that meant they had to charge so much for the few that were left, that people couldn't afford to buy them.

Ugly rumors began to circulate about their products: How they made their wire-wound resistors with a strand of metallic partial conductor wo an insulated tube; and their ca using compounds involving th ment of organic chemistry.

They didn't know what to it!

At last, before a great ga men making other radio confessed to their dilemma.

Instead of being horrified fession, the learned assembly moved. One by one, men condensers for a living, valv and many other things, admi same problem.

They were all in the o vehicle!

FACING RUIN

All too soon, the appalling came evident. The radio gam ing certain ruin and the wors that no one seemed to know about it.

No one except the janitor!

Now it so happened that reader of popular radio mag a very practical man. While coffee in a back room, he'd ing on the side!

Rather than see his coffe jeopardised, he tip-toed in a leave of the chairman to ma gestion. The chairman readi thinking it had to do with a of biscuit for supper. But Quoth the janitor:

"Why not avoid the impas men, by agreeing forthwith t sell parts which are near eno

"I know they'll work, be built up a complete receiver a in . . . (ahem) . . . from re which you've left for me sugar basin.

TECHNICAL TERM

"Only to make it truly scien have to think of a better te more technical term than near

Everyone was terrifically by the suggestion, only the that a committee ought to be choose the right word and d far away was near enough.

After a lot of haggling, it that the committee should co those who owned a slide rule ary uniform.

To cut a long story short, body (adjective not month unanimously on the use of "tolerance" but there the de bogged down.

that worked in receiver factor-
ed they didn't care if parts
pc off value, if they could only
cheaply.

ilitary types were more fussy
hey didn't have to worry about
ll. They wanted 10 pc or even
ether they needed them or not.
cap it all, the fellows who
instruments, most of them with
rules apiece, demanded 1 pc
g!

NITOR AGAIN

hen the committee looked like
up in disorder, the janitor, who
now been granted official per-
o leave his door open, came
with another brilliant sugges-

he again (being also a reader
speare):
emen, why not sort things out
marked 1 pc, 2 pc, 5 pc, 10 pc
c?
an sell the 20 pc ones cheaply
here'll be lots of them.
thers can be dearer and (aside)
ock the slide-rule boys like the
their one percenters!"

ajority said too-right, yessir or
according to their birthplace.
estion would benefit the radio
a whole. It would terminate
nce of several winged creatures
ngle piece of solidified clay.

on was duly proposed and sec-
d the committee repaired to
leaving the coffee to stand in
ill the following month.

ne men making resistors were
y at first, because they could
bout all the resistors they could

ere real obliging, too.
ad to be, because one of their
had left the firm and set up
ion!

n a customer wanted a fair
resistance, they picked on a
d number and supplied him
negs. This was much too much
r customer, so they made him
megs.

lse who wanted still smaller
y cut the figure in half again
up with quarter-megs.

stem of determining standard
d a lot to commend it, be-
e were all so easy to say over

emed silly to make half this
cause it looked such an odd
they settled for 0.1 meg., pro-
oint-one-meg".

JT TYPE

a very difficult man wanted
many ohms as 0.1 meg and
othing for it but to make him
2 negs. After all, it was still a
figure!

ws that the end. Customers
smaller and smaller values, so
d 75,000 ohms, 50,000 ohms,
s, 35,000 ohms, 25,000 ohms,
hs, and so on, right down to
s.

ile, the carpenters were busily
ns to hold all these new re-
n the signwriters would fol-
long, painting on the figures
n 1 pc, 2 pc, 5 pc, 10 pc and
ach separate bin.

y, hey had to put so many bins
ry to hold the resistors, that

there wasn't much room left to make them.

The crisis came when a lad, who had done first year at high school, got a job at the factory, in the store.

He noticed that the quarter-meg bin was nearly empty but there were plenty of point-two megs. So, without asking anybody, he picked out a lot of the high value ones, dipped their ends in green paint and dropped them in with the quarter megs.

When the foreman heard about it, he threatened to sack the boy on the spot. But, because he hadn't been to high school, he couldn't understand what the boy was talking about—percentage and all that!

Neither could the manager; so they called in an expert.

The expert suggested sacking the boy anyway for the sake of appearances, but he confided to the manager that the boy had really been right.

He explained that all the resistors in the 0.2 meg. bin, which happened to be above their marked value, were within the 20 pc tolerance of 0.25 meg. The reverse was also true.

What was more, he went right through the bins and proved that the same thing was happening over and over again; resistors in the same group were being stored in two places because the 20 pc tolerances were overlapping all the nice round values that the manufacturer was making. (Or something to that effect.)

He worked it out that, if the overlapping were eliminated, quite a few of the bins could be done away with and the manager could add another 20 feet to his office.

This was a radical suggestion, of course, and quite against the inclinations of all those who had grown used to the nice round figures. One would have thought they were producing motion pictures!

However, to cut a long story short (for the second time) the partners were called together and addressed by the expert.

A CHANGE NECESSARY

After a lengthy debate, involving the physical, moral and aesthetic aspects of the subject, it was generally agreed that the present system was both inefficient and illogical. That something ought to be done to reduce stock problems, to help their customers do likewise and to enlarge the manager's office!

At the final vote, there was only one dissentient, a very stubborn fellow who wouldn't see reason. And blow me down if he isn't still at it —writing letters now to the "Argument" columns.

Well then, for his benefit, let's go through the reasoning which has led to the adoption of this ridiculous, exasperating, pedantic, faddish, impractical system by military authorities, laboratories, component manufacturers, radio journals —and Radio, TV and Hobbies.

COMMONSENSE RESISTOR VALUES

Dear Sir,

For many years (on and off) of your journal, from the early days of Wireless Weekly and before commercial broadcasting, too, I have not found any fault with the technical articles previously. (Mainly because of my limited experience no doubt.)

However, for quite some time now there is a practice which is exasperating me, due to the sheer ridiculous pedantry of it all.

For a time it seemed to me to be just a temporary fad but, as it seems to be now a regular custom or habit, I wish to speak to you about it.

I refer to the matter of resistor values as shown in your technical articles.

Resistor values are now no longer .5, .05, .025, etc., but are now .47, .047, .022, .22.

Also low values of resistors are not any longer 300 ohm, 350 ohm, 250 ohm, etc, but become 330, 220 ohm, etc., etc.

This seems to me to be just an aping of laboratory practice where actual true values are shown and not the general values.

At the moment I am looking at some value operating conditions of an AWA manual, where resistor values are shown in "approximate" actual values such as 5550, 8300, 10,900, 11,400 ohm, but you will agree this is quite a different matter altogether.

In the case of a .022 resistor just what is meant? 20,000 or 25,000 ohm. You will probably say it does not matter. But do your readers always know it does not matter?

After all, the reader will have to buy a 20,000 or 25,000 ohm resistor. I cannot imagine requesting a retailer for a .47 resistor. If one does, he will, of course, say, "Oh, you want a .5 meg. resistor.

In any case with 10 pc tolerance resistors, one cannot obtain just what one requests whether .022, .047, .47, .44 or .044.

Please let us come down to earth again and be practical.

For a time I thought the craze was due to the whim of perhaps only one technical writer, but observation shows others too have lent their names to the silly practice.

Perhaps after all there may be only one person who is the power behind the throne, as it were, and responsible for it all.

If in your loyalty to your journal you cannot see it my way, please do not attempt to bulldoze me into agreeing with you by technical mumbo-jumbo.

On the other hand if there is any really sound reason for the practice, I can, of course, learn something, and be grateful, too, for the knowledge.

With all best wishes to you, whether you like the letter or not.

Yours faithfully,
F.M. (Parramatta, NSW).

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t place, the idea of a manu- erance is quite a sound one applies to just about every d article you can think of. es, the tolerance is small; in quite wide.

se of resistors for ordinary d amplifiers, a tolerance of en acceptable.

words, except for certain ions in the circuit, resistors plus or minus 20 pc with- ly affecting performance.

OUS BENEFIT

t it another way, one might inclusion of lower tolerance 20 pc would only increase uch equipment without con- practical benefit.

something else, too. If a 20 pc is not noticeable in circuits, then any deliberate ch a designer may want to normally involve increments than 20 pc. Something near- example.

system of rating resistors fy these requirements, main- t grew up around a lot of values.

eg. resistor is really too large 1.0 meg. for design pur- igh it is nominally a reduc- pc, which is a lot anyway, uch larger in practice when 20 pc tolerances are applied. n a reduction from 1.2 to 0.4 to 66 pc.

system plugged this gap by 0.75 meg. as an accepted .75 meg. is really too close Their tolerances overlap, gh-value 0.75 meg. can act- er than a low value 1.0 meg.!

0.25 meg. is really too far 0.5 meg., but some of the values which have appear- them, like 0.3 and 0.4 meg., p in their tolerance. So it n the scale.

the designer wants a closer alues than he can get from 5, 0.5 and 1.0 ratios of the But it only complicated the on for everybody to drop trary ratios in between them eir tolerances overlap.

D SYSTEM

national System of Preferred ch is what F.M. is really about, is a mathematically npt to solve this whole prob-

gain at say 1.0 megohm, the gnises the fact that 20 pc sistors will go down to 0.8 recognises that the next re- lower down the scale should nal value such that its upper incides with 0.8 meg.

ed value works out at some- an 0.7 meg. By the same next works out at just under

fact, to two significant fig- eed progression of values is 47, 0.33, 0.22, 0.15 and 0.1

ontinues in the same pro- 000, 47,000, 33,000, 22,000, 00, 6800 and so on. In o types are likely to be in- alues between 10 ohms and 10 megohms, and the above progression holds right through the range.

Value Nominal	Range Res.
100,000	80,000—120,000
150,000	120,000—180,000
220,000	176,000—264,000
330,000	264,000—396,000
470,000	376,000—564,000
680,000	544,000—816,000
1.0 meg	0.80—1.20 meg
1.5 meg	1.20—1.80 meg
2.2 meg	1.76—2.64 meg
3.3 meg	2.64—3.96 meg
4.7 meg	3.76—5.64 meg
6.8 meg	5.44—8.16 meg
10.0 meg	8.00—12.0 meg

A few nominal resistor valves and the spread envisaged by a 20% tolerance. In practice, most resistors sold these days are 10% or better.

A few nominal values and the 20 pc tolerance limits which relate thereto, are shown in an accompanying panel.

From the manufacturer's viewpoint, the system minimises wastage, because every single resistor which he makes can be graded, if need be, into one bin or another, without transgressing the 20 pc maximum limits. And further, because the tolerances don't overlap to any extent, the theoretical minimum number of bins is required.

His stock position is simplified, and likewise that for everyone who uses the resistors.

In practice, the techniques of resistor manufacture have so improved that it isn't necessary these days to take advantage of this latitude. Resistors can be made in batches in the knowledge that all but a few per cent. of them can be classified straight out as 10 pc tolerance types.

Preferred Component Values

20% Tolerance	10% Tolerance	5% Tolerance
10	10	10
		11
	12	12
15	15	15
		16
	18	18
		20
22	22	22
		24
	27	27
		30
33	33	33
		36
	39	39
		43
47	47	47
		51
	56	56
		62
68	68	68
		75
	82	82
		91
100	100	100

This table shows the key numbers on the preferred series of valves for 20%, 10% and 5% tolerance. Television receivers draw heavily on the 10% range.

Thus, when you buy resistors over the counter, you are normally supplied with 10 pc tolerance units at no extra charge.

For more critical design applications, which are not met by values in the major divisions already mentioned, the Preferred Value System interposes the multiples 12, 18, 27, 39, 56 and 82, so spaced that their 10 pc tolerance spread just meets the 10 pc tolerance spread of the major divisions.

Thus a resistor which falls just above the permissible 10 pc tolerance on 47,000 could be coded as 56,000 ohms 10 pc. Or, of course, it could still be sold as 47,000 ohms 20 pc.

TV REQUIREMESTS

With the arrival of television, the former fate is the one more likely to befall the said resistor, because TV receivers contain lots of resistors and lots of different values. One can thus expect to meet any of the resistor values (or multiples thereof) shown in the 10 pc Preferred Range.

For still more critical applications, the system provides for a 5 pc tolerance range, the limits just merging nicely with these already established for the 10 pc and 20 pc values. This is also shown in the accompanying table.

From the buyer's viewpoint, the table works this way: If, say, a 33,000 ohm resistor is required, it occurs in all three groups. In a "bargain" sale, you might receive a 20 pc resistor, but nowadays, from regular stocks at regular prices, you would almost certainly be supplied with a 10 pc type.

If you wanted a 33,000 ohm 5 pc, you would have to specify it and pay the extra.

However, a 39,000 ohm resistor is not made to a 20 pc tolerance, so one bought over the counter would have to be within 10 pc of marked value. But you could get it to 5 pc, if so specified.

The in-between value, 36,000, is not available in either 20 pc or 10 pc tolerance. If you ordered this value, you would normally receive a 5 pc type and pay whatever price applied to the 5 pc range.

SENSIBLE SYSTEM

But you see how the system hangs together. Even with low tolerance types, the tolerance margins do not overlap, so that at all times the full range of resistance values is covered with the fewest practical nominal values.

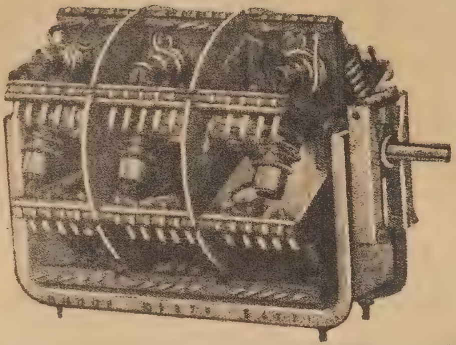
What of still more critical values? Say 2 pc or 1 pc?

In practice, the tendency is to discourage supplying such orders with selected conventional carbon resistors. Even if such resistors are within tolerance at the time of selection, they may easily drift out of tolerance while in service, thereby negating the whole purpose of using them.

Thus, low tolerance resistors recommended these days are high-stability types, made quite differently from the ordinary component. Though often in short supply, the usual course is to stock them in all the values listed for the 5

(Continued on page 53)

RECEIVER COIL TURRETS FOR HAMS



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F 320

**Specialised communications component
amateur receivers or low powered
mitters.**

PRICES

**Model F320 coil turret, complete with wound
slugs and trimmers, 500 Kc/s to 30 Mc/s.**
£20 (

**Model F320 coil turret as above but less coi
trimmers.**
£10 (

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1. Dimensions: Length 6½in., width 4ins., height 3½ins.
2. Frequency range: (6 bands) 500 Kc/s to 30 Mc/s.
3. I.F. channel. 455 Kc/s.
4. Coils complete with trimmers and slugs.
5 Stages available: R. F., Mixer, Oscillator.
6. Turret contacts—5 per coil—Rhodium plated.
7. Tuning condenser required—3 gang, 200 pF maxi
per section.
8. All circuits are Hi-Q with only best quality cer
trimmer condensers and polystryne coil formers.
9. Turrets also will be available less coils and trimmers
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10. Any coil bank may be extracted for modifications wit
interruption to operation of other banks.

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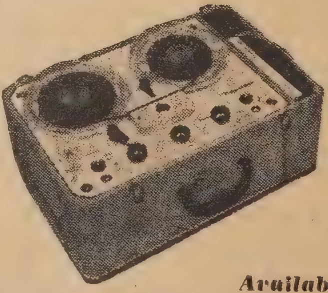

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plus other special values for
e is a known demand.

would typically include 9900
500, 250,000, 500,000, as so
in multimeters.

a single critical value is not
it is suggested that it be made
nnecting two other values in
parallel, the assumption being
ost of two such resistors would
than that of a specially made
d "special".

w does all this affect Radio,
Hobbies?

has made things a trifle awk-

r, the logic of the preferred
obvious, and, having been
y most everybody that mat-
adoption in the home-builder
inevitable.

EASY

ereas an engineer merely has
his staff and purchasing agents
to switch to preferred values,
was not so easy. We had to
get people used to these new
We had to wait till radio
ame used to supplying them or
d to do so by supply and de-

nonths ago, we reckoned that
on had changed sufficiently to
00 pc use of preferred values,
why our circuits have been
hem of late.

, if we show an odd-looking
odd-looking to you, anyway),
cause we have adopted some
rking in measured values. It's
at we have fallen into line
ternationally recognised stand-

e say 22,000, that's the value
not 20,000 or 25,000.

e say 0.47 meg., that's the
mean you to ask for. If your
ts on supplying you with a
by all means take it, but show
to the purchasing agent, so
go on perpetuating the past.

nally, if you go into a good
es around the place, these days,
r a 0.5 meg., the chances are
come out with one having a
dy, a violet spot and a yellow

, tut. Now I'm perpetuating
It will have a yellow band, a
d, and a yellow band, in that

e you are. Hope you like our
n, FM. Even if you didn't, we
riting it. And, one thing more:
numeral system is applicable
ors, and for the same reasons.
for your letter.

SIDEBAND

at of last month's letter about
-sideband problem, about the
f using single-sideband for an
nsmission?

ay remember that D.B. of
Victoria, worked out that it
tty silly practice because, after
f one sideband and the car-
at was left would be a single
which could far more easily
transmitted in the first place!

I left the letter without comment but no one was apparently wanting an argument on that score; so I guess it's up to me.

First I must confess that D.B. has the advantage, in that I have never heard of SSSC being used in this role — nor had a couple of other folk to whom I mentioned the letter. Therefore I can't accuse anyone of indulging in this silly practice.

One man did suggest that D.B. was being confused by frequency shift keying, which is a quite different thing. Alternatively, that some station normally using SSSC transmission for telephony may simply have routed some MCW through the channel, rather than resort to another method of transmission.

The other man was more to the point. He wanted to know how D.B. could possibly identify MCW SSSC anyway? (What a wonderful collection of initials!)

He reasoned that if it was proper MCW SSSC, the only radiated evidence would be a single interrupted frequency exactly the same as a normal keyed CW signal — as far as the listener was concerned. How would D.B. possibly know the diference?

A good point, I would say.

DREADFUL THOUGHT

The only thing that worries me is that D.B. or some other resourceful person might work out that, since the two are the same, a whole generation of Amateur brass pounders has been using MCW SSSC without knowing it.

No wonder the morse code is so darned difficult!

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PATON M.32

Features 32 indispensable, easy-to-read ranges so necessary for modern Radio-Electrical installation and service. Has 4in meter scale, all measurements from two terminals, bakelite housing, tests leads supplied. Ranges covered—

Volts DC. 0/0.1-3-10-30-100-300-1000.
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PATON M.42. Spring loaded Jewel bearing meter movement enclosed in a semi-hard rubber housing enables high accuracy to be maintained under adverse conditions. Specifications similar to M.32, but has an inbuilt 0/10 Amp. AC. current range (covered in same steps as M.32 DC. current range), as well as an ext. current transformer position. : 3 much-needed resistance ranges 0/3000, 0/300000, 0/3 megohm, and a 0/25 Micro-farad capacity range make it a most complete 1000 Ohm/V instrument. Genuine value at £32/12/6 plus 12½% tax. Easy Terms Available.

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New Rola 6in x 9in Ovaltone extension speaker. Mounted in durable and attractive plastic-covered cabinet,

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12mfd 525V	4/6
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Heavy duty 12in per-mag speaker by well-known manufacturer. 10T, CT, or 5,000 Transformer **£2/17/6**

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30/- PER 100

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Color Code Card Supplied

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OVAL SPEAKERS

(6/9H) 9″ x 6″ per mag Speaker with 5T Transformer

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(5F) 5″ per mag with 7T Transformer **£1/4/-**

5″ Dynamic 1,500 ohm Field 7T Transformer **£1/17/6**

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7in Dynamic speakers by leading manufacturer, 1,500 ohm Field Coil, 7,000 ohm Transformer

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100 I.R.C. carbon resistors, ½, 1 & 2 wa in values 50 ohm to 5 meg. includi many popular sizes, 3T, 15T, 20T, 2 50T, 100T, 250T, 500T, etc.
(Standard resistor color code supplie
Box of 100. **18/**

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5	15/-	6J8	15/-	EL32	9/6	EBC33	9/6
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7	9/6	78	7/6	955	5/6	12SR7	3/6
7G	7/6	6J6	12/6				

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in innoval wafer per doz.	10/-
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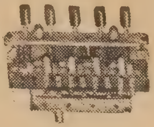

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New control box fitted with above switch also 5 bezels with globes & multi contact key switch.
Postn.s.w. 2/-
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RANGE: 0-5 amps. (can be extended by shunts).
DIAMETER: 7½ inches **28/6**

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£8/10/-
LESS VALVES AND GENEMOTOR £3/15/-

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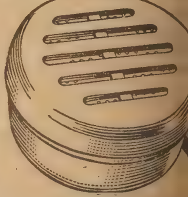

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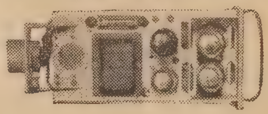

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Fully Laminat Fields, Wou Armature, Sixt Segment Co mutator, b bearing Arr ture. Ideal Model Trains, Hobbyists, etc. Condit New.
Price, each .. .. .32/
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Flexible drives to suit command transmitters or receivers
5ft 6in long __ __ __ __ __ __ __ __ __ 10/- Plus postage
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These Mantel Vibrator Chassis made by leading manufacturer have R.F. Stage and are supplied complete with Rola 9in x 6i oval speaker, valves and vibrator supply for 6 volt operation. Give good results on local, interstate and overseas station wit excellent tone. CHASSIS ARE NEW BUT SHOPSOILED. Ideal for building into caravans, boats, etc. Size of chassis, includin dial, speaker and vibrator supply. 14in long x 10in deep x 14in high. LIST PRICE OVER £40/-/-

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PHONE LM3610

USING JUNCTION TRANSISTORS

article provides an excellent summary of junction transistors, their application and their acteristics. It is reprinted by arrangement with Mullard-Australia Pty. Ltd. from their leaflet "Junction Transistors For The Home Constructor".

moment transistors are made e form of triodes, with three known as emitter, base and

the valve triode can be oper- either the cathode, the grid or earthed, the transistor can be with emitter, base or collector

etches in Figs. 1 to 3 show the d transistor arrangements side or the sake of comparison. As es emitter and collector sug- emitter is connected as if it cathode, and the collector as the anode.

DED EMITTER

rounded emitter connection is commonly used circuit ar- t, and is the one which gives plification.

nitter is common to the input ut circuits, the input is applied se, and the output taken from tor.

rrangement produces a static ain, which can be as high as in the transistors at present

tors, it should be remembered, nt operated devices, and it is efer to current gain, and power stage, rather than to voltage

grounded emitter arrangement t impedance is higher than the pedance, so there is some in, and a correspondingly high in (measured in db) per stage. e of the input signal current d by 180 degrees.

DED BASE

grounded base circuit the cur- (denoted now by the Greek ha) is slightly less than 1. OC71, for example, it is 0.98. impedance is lower, and the pedance higher, than for the emitter arrangement. So the base circuit primarily produces ain.

of its low current gain, the in per stage is less than for ded emitter circuit. There is al of phase between input and

cuit is suitable for DC coupling preamplifiers requiring a low high output impedance match. n transistors in grounded base ded collector circuits can be scillate up to frequencies about times as high as those for a emitter oscillator.

-off frequency is 400 to 500Kc C71 with grounded base, and f the order of 10 to 20Kc for with grounded emitter. (The quency here is defined as the at which the current gain with t short-circuited falls by 3db C value.)

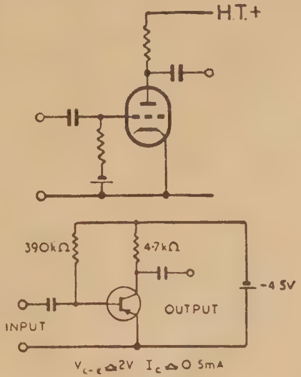


FIG 1

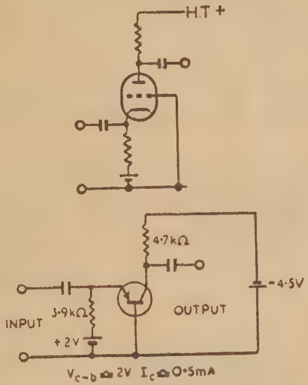


FIG. 2

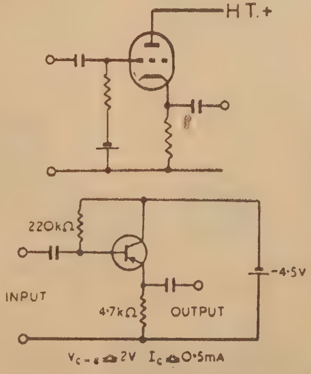


FIG. 3

GROUNDED COLLECTOR

This method of connection corresponds to the 'cathode follower' valve circuit, and is used less often than the previous two arrangements. The collector is effectively earthed to AC, the input is to the base, and the output is taken from the emitter. There is high input and low output impedance.

The current gain is similar to that for the grounded emitter circuit, but the voltage gain is always slightly less than 1.

The grounded collector circuit is used primarily as a matching or buffer stage. Its high input impedance and low output impedance make it suitable for matching the high impedance output of one grounded emitter transistor into the low impedance input of the next.

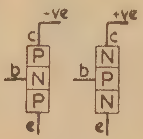
This method of coupling brings with it lower gain over the three transistors, but retains the small phase shift and economy of R-C coupling.

Having mentioned R-C coupling, a brief account of the usual transformer coupling is required to put the matter in perspective.

As transistors are current operated, the coupling transformers must step down the voltage to provide current gain and have more primary turns than secondary turns. For maximum transfer of power from the source to the load their impedances must be equal.

If the impedance ratio of the output of one transistor to the input of the next is about 20, take the square root to find the turns ratio, and a step-down ratio of about 4.5:1 is suitable.

A transformer ratio of 1:1, that is, a simple choke feedback, may be permissible at low levels of standing voltage and current.



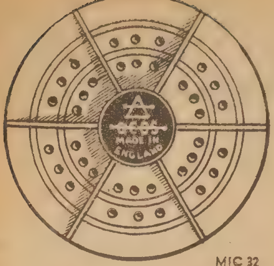
OPERATING INSTRUCTIONS

Transistors are perhaps more tricky to use than valves, although mechanically they are more robust. Like everything else, however, they have to be treated properly, and can be damaged and even destroyed.

The constructor knows by instinct, without having to stop to think about it, that he must not place 100 volts positive on the grid of a valve.

It may be some time before you get just that familiarity with the completely different limitations of transistors. The notes and precautions which follow should be regarded in this light.

(Continued on page 61. For typical circuits, see page 59.)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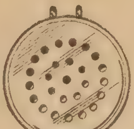
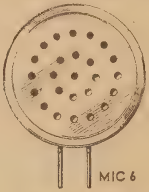
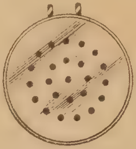

MIC 3


MIC 6


MIC 19

MIC 23

MIC 15

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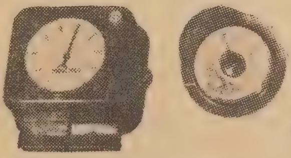
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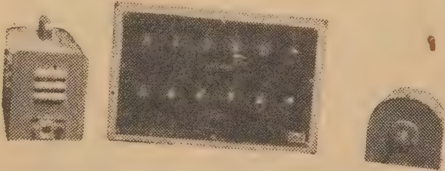
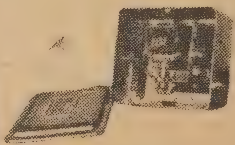
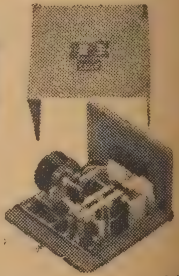

Timer indicating 1/1000th sec. accuracy plus minus 1/1,000,000 sec.


Manufacturers Type Timer.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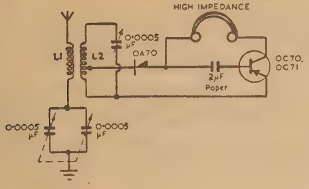
ICAL CIRCUITS using OC70 and OC71 Junction Transistors

I.


HIGH IMPEDANCE
L1
L2
0·0005 µF
OA70
2µF Paper
OC70, OC71
0·0005 µF
0·0005 µF

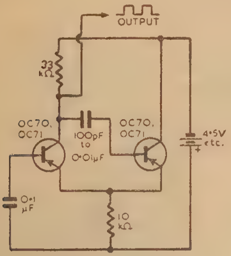
(Origin: ' Radio Electronics ', April 1955)

from the OA70 consists of an audio component and a d.c. derived from the rectified carrier wave. The d.c. component the collector supply voltage, the audio component being fed capacitor to the base. The diode *must* be connected as shown, hode to the tuned circuit. A good aerial is essential.

L_1 = 110T on 2" dia. former 24 s.w.g. (d.c.c.)
L_2 = 90T on 2" dia. former 24 s.w.g. (d.c.c.)
(diode tapping 35T from lower end)

2.

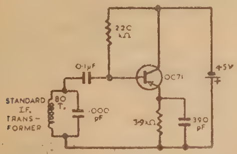
RATOR


OUTPUT
33 kΩ
OC70, OC71
100pF to 0·01µF
OC70, OC71
4·5V etc.
0·1 µF
10 kΩ

use is as a ' noise source ' for finding a faulty stage when lio receivers. The coupling capacitor may be made variable according to individual choice. The values shown on the ive frequencies of approx. 7kc/s and 100c/s respectively.

3.

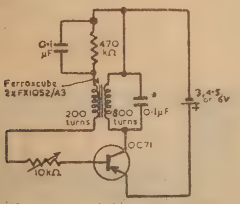
SCILLATOR


220 kΩ
0·1µF
OC71
4·5V
STANDARD I.F. TRANS-FORMER
80 T.
.000 pF
3·9kΩ
390 pF

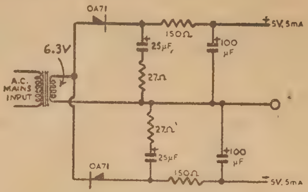
uit for the home constructor or service engineer for aligning its of radio receivers, it could also be used as b.f.o. in com- receivers by making the 1000pF capacitor variable. Use a can, taking about one-third of the turns for the tuned circuit. ber of turns will oscillate at a lower frequency.) The tuning should be 700-1500pF, depending on the i.f. can used. For ng the 80T tap on a 270T winding, a tuning capacitance of F is required. These large capacitances are sufficient to iput capacitance of the transistor. The output is taken from e 3·9kΩ resistor in the emitter circuit, or from the top of the

4.

CILLATOR


0·1 µF
470 kΩ
Ferroxcube 2xFX1052/A3
200 turns
800 turns
*
0·1µF
3, 4·5, or 6V
OC71
10kΩ

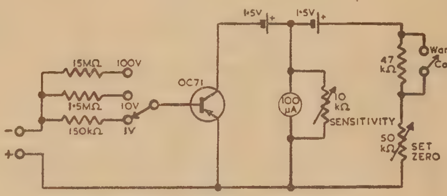
eful audio source for morse practice or checking audio es. The 0·1µF capacitor* may require alteration if a different is used. The 10kΩ resistor in series with the base varies the d also the output waveform.


OA71
150Ω
+5V, 5mA
25µF
100 µF
6.3V
27Ω
A.C. MAINS INPUT
27Ω
25µF
100 µF
OA71
150Ω
-5V, 5mA

CIRCUIT 5.

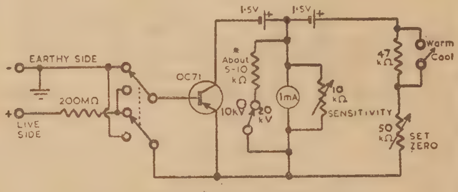
POWER SUPPLY

This circuit is intended to supply experimental transistor circuits, and gives two outputs—one positive with respect to earth and the other negative. Various outputs can be obtained by varying the values of the 150Ω smoothing resistors. For improved hum reduction choke smoothing may be used.


1·5V
1·5V
15MΩ
100V
1·5MΩ
10V
150kΩ
1V
OC71
100 µA
10 kΩ
SENSITIVITY
47 kΩ
Warm
Cool
50 kΩ
SET ZERO
-
+

CIRCUIT 6. TRANSISTOR VOLTMETER

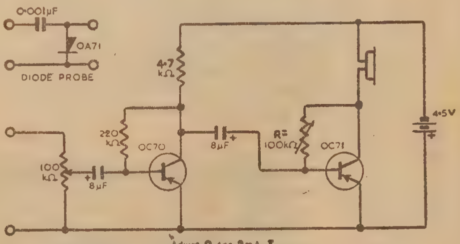
This circuit makes use of the fact that, in the grounded emitter connection, a very small input current is required by the transistor. The input resistance on the highest range is 15MΩ which is comparable with that of a valve voltmeter. Before use the zero should be adjusted with input short circuited. If zero balance cannot be obtained in the ' Cool ' position of the switch, it should be switched to ' Warm '. The sensitivity can then be adjusted by connecting a known voltage to the input terminals.


1·5V
1·5V
EARTHY SIDE
200MΩ
LIVE SIDE
OC71
* About 5-10 kΩ
10kV
20 kV
1mA
10 kΩ
SENSITIVITY
47 kΩ
Warm
Cool
50 kΩ
SET ZERO
-
+

* 5-10kΩ depends on transistor

CIRCUIT 7. E.H.T. VOLTMETER

Basically the same as (6), the same notes apply with regard to setting up. It is a new approach to the problem of measuring e.h.t. in t.v. receivers. Care must be taken in the construction of the probe containing the 200MΩ resistor. The Dubilier high voltage resistor type MVA/200MΩ may be used for this.


0·001µF
OA71
DIODE PROBE
4·7 kΩ
220 kΩ
OC70
8µF
R= 100kΩ
OC71
4·5V
100 kΩ
8µF

Adjust R for 3mA I_c

CIRCUIT 8. SIGNAL TRACER

This is essentially a two-transistor amplifier for signal tracing, in the audio stages of a receiver. By the addition of the diode probe it can be used to trace signals in the i.f. or r.f. circuits of a receiver.

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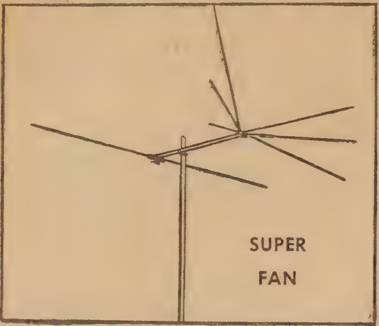

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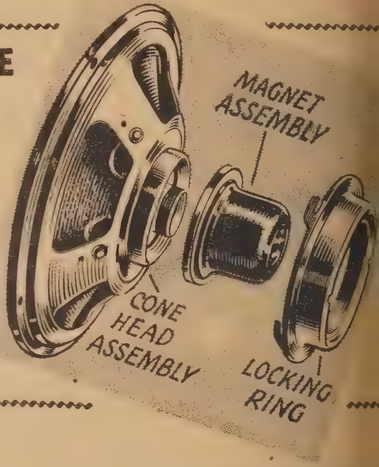
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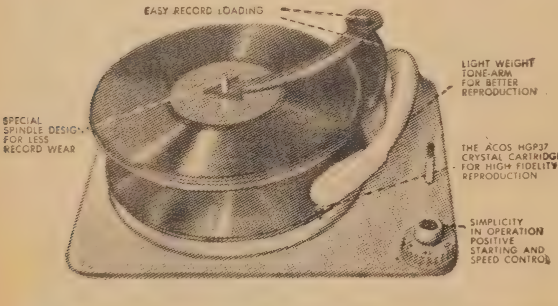
CONE
HEAD
ASSEMBLY
LOCKING
RING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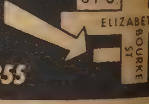
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he junction transistors available
cially in this country at the
are of the P-N-P type. The
and collector are the two outer
f the three in the transistor, and
made of P-type semiconductor.
se is the middle layer of the
h, and is made of N-type semi-
or.

mitter sends out "positive holes"
ass through the thin base layer
ve on to the collector.

ler to attract the positive holes,
ector must be connected to the
side of the battery. For P-N-P
rs the "HT" line is negative!

e you do get hold of an N-P-N
r, remember that the current
nitter to collector now consists
v of negative electrons, and the
is then positive.

sing the polarity of a transistor
roy it.

CTOR DISSIPATION

mount of current passed by a
r increases rapidly with temp-
The maximum collector dissipa-
en in the data must therefore
account be exceeded, even for
ngths of time.

igh a dissipation will overheat
sistor; the rise in temperature
f increase the current, and hence
the temperature even further.
the transistor may get into a
condition, until it eventually
own.

stors heat up very quickly under
d of overload conditions. The
d average limiting values for
and currents (and other limit-
s) are absolute ratings and must
xceeded.

ansistor can be damaged by an
of short duration, such as that
by the discharge of a large
.

also be damaged by the heavy
rrents which occur when con-
t into a circuit with the power
power should always be switch-
st.

ʀATURE

what has just been said on the
f dissipation, it should be clear
nsistors must not be sited in
where the temperature exceeds
fied limit (for example, 45 de-
for the OC71).

haracteristics are usually given
perature of 25 degrees C.

ldering of the transistor into
ould be completed as quickly as
otherwise it may "soak up"
of the iron.

l pair of pliers placed across
will act as a thermal shunt
ce the possibility of heat being
l to the transistor.

ads should not be bent at a
arer than 1.5mm to the seal.
are sometimes silver-plated or,
soldering even easier, gold-
his gold plating should not be
to be a tarnish.

SENSITIVITY

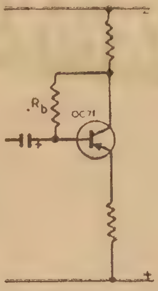
current carriers (electrons and
"holes") are released by the
f light on the semiconductor
aterial used to make transistors.
rs are provided with a light-
oating which must not be

D.C. STABILISATION

The working point of a transistor is specified by the collector voltage and current (thus Ic equals minus 3mA, Vc equals minus 2V), the inward direction of current being taken as positive for both collector and emitter.

Because of the effect of the temperature of the surroundings on transistor performance and the need to allow for the spread of production in transistors, some form of stabilising should normally be included.

FIG. 5



This is particularly important in the early stages of transistor amplifiers, which normally operate at quite low collector currents.

In practice, the collector current can never be less than a certain value which flows, even when there is zero input signal.

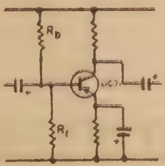
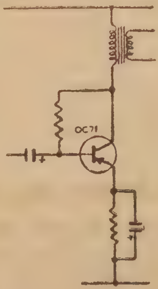


FIG. 6

The minimum current consists of (1) the small back leakage current across the diode and (2) the "thermal" current set up by small imperfections in the crystal. This minimum value is normally denoted by the expression Jc(o).

In the grounded emitter circuit, because of the current amplifying effect, the collector current for zero input current is very much greater.

FIG. 7



By adopting special circuit precautions, a transistor can be operated with adequate stability below this last-named figure but not below Ic(o), as previously defined.

For an OC71 at 25 degrees C, the minimum current figures are 150 microamps for grounded emitter operation and 8 microamps for grounded base.

These quantities become from 5 to 8 times larger, when the temperature is raised from 25 to 45 degrees C. Also, they vary from one transistor to the other.

Reliable transistor circuits can be designed nevertheless by applying negative DC feedback to stabilise the working point.

When the working conditions are such that the largest anticipated initial current is a smaller proportion of the collector current, the problem is not so severe.

USE OF CURVES

Once the working point of the transistor has been chosen (and in practice the choice will be restricted by the available supply voltage and load resistance) the corresponding base bias current can be found from the static characteristic curves.

In a transistor with a low Ic(o), the collector voltage will be higher and the collector current lower than they should be for the appropriate base bias current determined for a nominal transistor.

Stabilising has the effect of increasing the base bias so that the working point moves to the correct values of collector voltage and current. (The action takes place in the opposite direction for a high Ic(o).)

In effect stabilising can be achieved by introducing degeneration into the circuit. The method is known as self-biasing, because the bias current to the base is obtained through a resistor connected to the collector.

Fig. 5 shows the arrangement. The base bias resistor Rb is held at the collector voltage, hence its value is given by Rb equals Vc/Ib.

If now the collector voltage tends to be high (through using a transistor with a low Ic(o)), the base bias current tends to increase and offsets the change.

When the collector voltage goes low (because of a transistor with a high Ic(o), or because of a rise in temperature), the base bias current falls.

Resistor Rb primarily provides base bias, but its stabilising action is quite effective. It also introduces some AC negative feedback, however, which reduces the gain.

BETTER STABILITY

An arrangement which gives better temperature stability than self bias, while still requiring only one battery, is illustrated in Fig 6. Rb and Rf together form a potential divided across the supply. The current through Rb is equal to the base current Ib plus the current through Rf. A smaller value now has to be given to Rb to maintain the same total base bias current.

The increase in stability is obtained at the expense of slightly higher drain on the battery. Any increase in current (produced by a rise in temperature or transistor spread) results in increased current flowing through the emitter resistance.

The voltage drop across this resistance reduces the voltage available across Rb, and hence reduces the bias current. The reduction in bias current, of course

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Sec.: 2 or 8 ohms.
Resp.: As for 916-15.
Valves: As for 916-15.
19% Screen Taps.

TYPE 949: 12 watts.
Prim.: 8000 ohms P.P.
Sec.: 2, 8, 12.5 and 15 ohms.
Resp.: 10-50,000 cps.
Valves: 6V6, 6BW6, KT61, EL84, etc.
19% Screen Taps

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TYPE 2505 — 12 watts
Prim.: 6000 ohms C.T.
Sec.: 3.7 or 15 ohms.
Resp.: 10-50,000 cps.
Type 2505-8 for 2 or 8 ohms Sec.
Type 2505-15 for 3.7 or 15 ohms Sec.

SPECIAL HI-FIDELITY +—1 db 20-40,000 cps

OUTPUT TYPE

TYPE 870 — 6 watts.
Prim.: 10,000 ohms P.P
Sec.: 2 or 8 ohms.
(for "Rola" 120X)

TYPE 871 — 12 watts.
Prim.: 10,000 ohms P.P
Sec.: 2 or 8 ohms.

TYPE 872 — 12 watts
Prim.: 10,000 ohms P.P
Sec.: 3.7 or 15 ohms.

HIGH FIDEL +—1 db 30-15,00

OUTPUT TY

TYPE 763 — 15
Prim.: 5000, 3000 P.P.
Sec.: 15, 12.5, 8, 3. 2 ohms.

TYPE 920 — 15
Prim.: 5000, 3000 P.P.
Sec.: 500, 250, 16 and 100 ohm

TYPE 897 — 15
Prim.: 10,000, 8000 P.P.
Sec.: 500, 250, 16 and 100 ohm

TYPE 896 — 15
Prim.: 10,000, 8000 P.P.
Sec.: 15, 12.5, 8, 3. 2 ohms.

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MEDIUM FIDELITY

TYPE 809 — 15 watts.
Prim.: 500 ohms.
Sec.: 15, 12.5, 8, 3.7 and 2 ohms.

TYPE 914 — 15 watts.
Prim.: 5000, 3000 ohms P.P.
Sec.: 500, 250, 166, 125, and 100 ohms.

TYPE 915 — 15 watts.
Prim.: 5000, 3000 ohms P.P.
Sec.: 15, 12.5, 8, 3.7 and 2 ohms.

+—2 db 50-12,000 cps

TYPE 917 — 15 watts.
Prim.: 10,000, 8000 ohms P.P.
Sec.: 500, 250, 166, 125 and 100 ohms.

TYPE 918 — 15 watts.
Prim.: 10,000, 8000 ohms P.P.
Sec.: 15, 12.5, 8, 3.7 and 2 ohms.

TYPE 922 — 25 watts.
Prim.: 800 ohms P.P.
Sec.: 500, 250, 166, 125 and 100 ohms.

TYPE 891 — 25 watts
Prim.: 6600 ohms P.P.
Sec.: 500, 250, 166, 125 100 and 83 ohms.

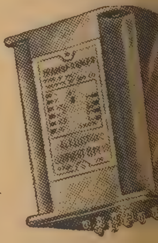
TYPE 892 — 55 watts.
Prim.: 3200 ohms P.P.
Sec.: 500, 250, 166, 125, 83, 62 and 50 ohms.

SINGLE ENDED

plus 2db 50 — 12,000 cps. **TYPE 928—5 watts.**
Prim.: 7000, 5000 ohms.
Sec.: 12.5, 8, 3.7 and 2 ohms.

TYPE 929 — 10 watts.
Prim.: 4000, 2500 ohms.
Sec.: 15, 12.5, 8, 3.7 and 2 ohms.

TYPE 930 — 10
Prim.: 4000, 2500
Sec.: 500, 250 an ohms.



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the collector current, and so he original increase.

ical power output stage is shown 7. Stabilisation is assisted here bypassed emitter resistor in the :ircuit.

naximum stabilisation the emitstor should be made equal to impedance (contributed by the ner). However, the emitter reen wastes 50% of the available and reduces the maximum effiof a Class A stage from 50%

nost circuits, provided the tran- not on the limit of production, ter resistor can be considerably If the emitter resistor is left sed, the effect is similar to leav- cathode resistor unbypassed in circuit.

lso "DC Stability of Transistor ' by Francis Oakes in the April, sue of Wireless World.)

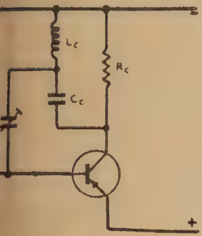
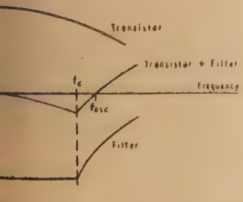


FIG. 8

ISTOR PHASE SHIFT

cillator can be regarded as an with positive in-phase feedm output to input. The feedcuit has to provide the correct of phase shift which, added to se shift across the transistor, required relationship.

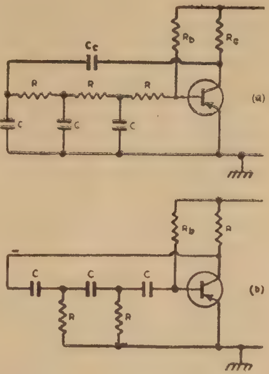
tunately it is only for low fre- that we can say, as an approxi- that the phase shift across the transistor is 180 degrees for l emitter or 0 degree for l base and grounded collector. phase differences are measured input and output currents.)



igher frequencies the current gs on its low frequency value. orm of grounded emitter phase- ated oscillator (patent applied shown in Fig. 8. Feedback is rom the collector to the base apacitor Cb instead of through ormer.

oltage across Lc leads the col- rrent Ic by 90 degrees. Hence citively coupling the junction of Cc to the base, the base cur- can be made to lead by approximately 90 degrees on the voltage at this point and hence lead Ic by 180 degrees.

The exact condition is obtained by varying Cb. Resistors Rb and Rc provide the DC paths for the base and collector.



The frequency of oscillation is determined by the conditions producing zero phase shift between feedback and input currents, not by the resonant frequency of the LcCc network. The reactive components Cc, Cb, Lc form the high pass filter, Cb being adjusted to alter the cut-off frequency fc of the filter.

For some frequency above the cut-off frequency (Fig. 9), the phase shift of the filter added to the phase-shift in the transistor produces zero phase shift. Thus the operating frequency is given by the point at which the "transistor + filter" phase shift curve crosses the horizontal axis.

R-C phase shift oscillators can only be designed for grounded emitter operation.

For the three-section networks shown in Fig. 10, an effective current gain of at least 29 times is required, to overcome the attenuation of the network. The networks shown are suitable for feeding into the low impedance input of the transistor.

In Fig. 10 Rb is the base bias resistor and the three equal resistors R-R-R and three equal capacitors C-C-C form the feedback network. In (a) it is necessary to include a DC path Rc and a blocking capacitor Cc for the collector.

When we allow for the phase shift in the transistor, in (a) it may be possible to replace the phase shift in one of the sections by that occurring in the transistor. In (b) it is necessary either to add a fourth R-C section or to increase the phase shift in the existing three sections.

EXIT PHONE BELL

A MUSICAL tone may soon replace the familiar telephone bell. Undergoing major field trial shortly telephones that radiate various tones through a louvred area in the base of the set will be tested for customer reaction.

The experimental site, Crystal Lake, Illinois, US, was selected for the variety of the telephone equipment it affords—some 300 customers on 100 telephone lines, ranging from individual to eight party rural services.

In this experiment the tones will be transmitted (using transistorised equipment) with the same amount of power required for a telephone conversation—considerably less than is needed to make a telephone ring. The ordinary telephone bell requires 85 volts; the transistorised device less than one.

An advantage rated high by engineers is that the new device is an aid to the partially deaf. This is because the musical tone contains more energy in the middle frequency range, where there is ordinarily less loss of hearing.

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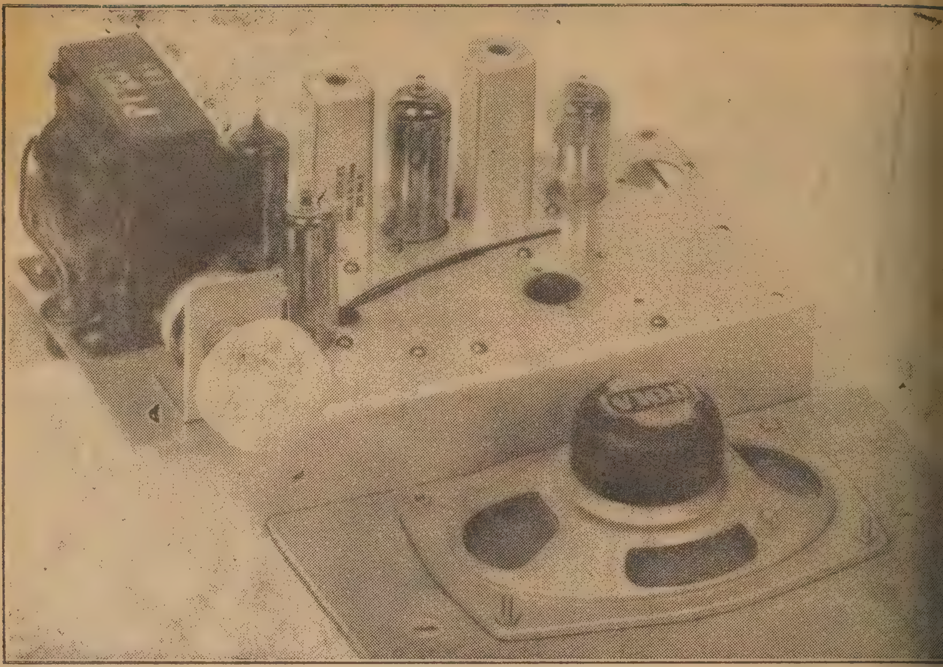


Your set will look something like this when you have completed this month's work. On the right of the chassis is the 6AE8, the 1st. IF transformer, the 6BH5, the 2nd. IF, and 6BV7 in that order. The two spare holes will take the aerial and oscillator

THE "LITTLE GENERAL" FOR 19

Well, how did it go last month? Finished the first section? Good, here is the second sect
coming up. There is not quite so much mechanical work this month, but a fair amount of
tailed wiring to make up for it.

By PHILIP WATSON

BEFORE commencing a description of this month's work it might help if we briefly reviewed what we built last month. This consisted of the power supply and output stage which, together with the speaker temporarily connected, constitutes a complete, if simple amplifier.

The power supply consists of a transformer, a rcetifier (the 6X4 valve), two electrolytic capacitors, and a 1500 ohm resistor. The transformer isolates the set from the mains proper—an important point in the interests of safety—and also provides voltages at the various values we require.

One of these is the 6.3 volts required for the valve filaments (or "heaters") and the other a 225-volt winding for the HT supply. The 6.3 volts can be left in the form of AC but the HT requires to be changed to DC.

The rectifier does the first part of this job by making the current flow in only one direction. However, it is still far from smooth and needs to be "filtered" before it can be used. The two electrolytics do this job, the 1500 ohm resistor serving to isolate one from the other to enable a better job to be done by each.

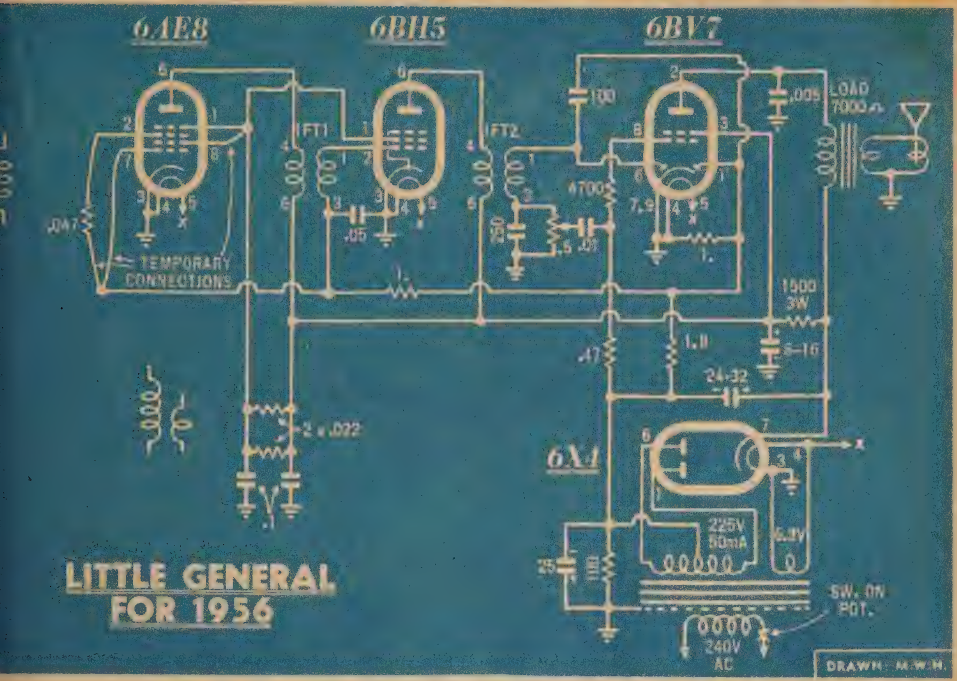
This is a simple filter system. More elaborate ones use a choke in place of the resistor. This gives better filtering, since the choke does some of the work as well as the capacitors. The result
is a lower hum level, a
the system we have chosen giv
good results in a simple set.
matter of interest, we have left
room under the chassis to fit a
at a later date, if this is preferr

The 6BV7 forms the true au
plifier portion and, in case you
too clear as to just what we m
an audio amplifier, the followin
help you to grasp the idea.

An audio amplifier is one
to handle signals at audible
"audio") frequencies; signals wh
in the final form which we requ
our loudspeaker, except that the
not be strong enough. They
operate a pair of headphones -

A MODERN MANTEL RECEIVE

ECOND SECTION —DETECTOR, IF STAGE, & AVC



are this circuit with that published last month and you will see clearly the extra parts and wiring we have added this month
Note that some of the connections around the 6AF8 are temporary only, to permit testing at this stage.

that they are audible—but need ening (or amplifying) consider- fore they will operate our loud-
.

6BV7 valve takes the weak audio from the detector circuit and them to the point where they erate our speaker. The fact that valve can do this as well as it something of a triumph for the esigners, and means that we can se a single valve where we would se have to use two.

UATE GAIN

ittedly, the gain is less than if d two valves, but it is still ade- or local reception, while simplify- set and reducing the cost.

output from a gramophone pick- also an audio signal so, if we is into the valve in place of nals from the detector, it is ble to expect that it will be d and appear in the speaker. quite correct, the only proviso hat the original signals must be rong, such as from the popular " type pickups.

foregoing and necessarily brief brings us up-to-date and we now the next step.

is to add the detector, the AVC tic volume control) system, the IF (intermediate frequency) channel, and part of converter (or frequency-changer) system.

The detector circuit uses one of the two diode plates included in the 6BV7 (pin No. 6) and its purpose is to convert the modulated intermediate frequency signal to the audio signal we have already discussed. This is a vital part of all receivers and is the part played by the crystal in the humble crystal set.

The other diode (pin No. 1) is used for the AVC system. This is an ingenious arrangement whereby the strength of the incoming signal is used to control the gain of the receiver. Thus a strong signal reduces the gain abruptly, a weak signal not quite so much. The set achieves maximum gain under conditions of very weak or non-existent signals.

USEFUL FEATURE

While an AVC system can never completely compensate for variations in signal strength, it does help a great deal and avoids the annoying "blasting" and overload which can otherwise occur when tuning from a weak station to a strong one. A conventional manual control is, of course, still required to adjust the volume for individual requirements.

The IF channel performs the dual task of amplifying the wanted signal while rejecting unwanted signals on each side of it. It does this particularly well, mainly because it has to work at only one frequency and this frequency can be chosen to give the best possible result.

This is a far better arrangement than trying to amplify the wanted signal at its original frequency, since it is difficult to provide circuits which will perform equally well over the full range of the broadcast band.

Thus we convert each signal, as it is required, to the intermediate frequency, where it can be handled under much more favorable conditions. It is the job of the frequency converter valve and its associated coils to select and convert the wanted signal, but we will have more to say about this next month. However, you should appreciate that this is the basic difference between a superhet and other forms of receiver.

NEW PARTS

The above should give you a brief background to the portion of the set we are going to build and enable you to appreciate something of the reason behind the things you will be doing.

Next we must consider the parts you will require. A detailed parts list will

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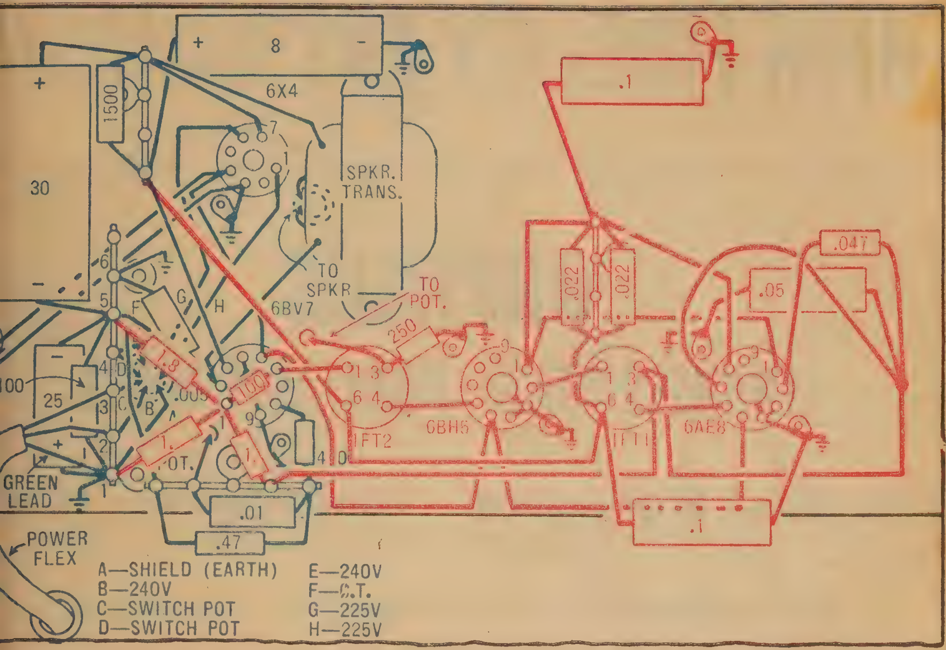
HIS MONTH'S WIRING IN DISTINCTIVE COLOR



gram is presented in two colors to differentiate between last month's work and this month's. The new wiring is shown in red. Compare this with the underchassis photograph overleaf.

elsewhere in the article, with parts shown as additional to ed last month. However, we with some of these in detail.

lained last month, the fact that y a certain brand is merely suitable physical characteris- does not imply a preference in respect.

ms with which we are mainly this month are the two IF ers. These are Aegis type J32 and J33 (No. 2). They are pes, having internal adjustable alignment.

TOUCH

cores can be seen inside the hole at both top and bottom has a screwdriver slot to per- justment. As you receive these be adjusted very close to the tting and they should not be ntil facilities are available to m.

rminal lugs protrude from the f each and are numbered for ion. In addition you will prob- that pin six is marked with a This is to identify it with the utlined terminal on the carton thus serving as a reference.

are not perfectly sure of this nt you can work to the fol- ta: 1st IF (J32) Pin 1, grid. VC. Pin 4, plate. Pin 6, HT. 33) Pin 1, diode. Pin 3, diode 4, plate. Pin 6, HT.

ond IF is mounted immediate- ide the 6BV7 socket. Then comes the 6BH5 and the first IF. Correct orientation is important and that used in the original keeps all the vital leads quite short. Check this point carefully when mounting both the IF transformers and the valve sockets. The exact details are shown in the wiring diagram.

When mounting the IF transformers take care not to exert excessive pressure on the mounting nuts. The lugs on which they are screwed are fastened to a relatively soft aluminium can and are easily torn off if one is too heavy-handed.

Two more miniature nine-pin valve sockets are required and we have specified the wafer type in each case. We suggest that the moulded type be avoided in this set, particularly for the 6BH5, since there appears to be a greater tendency to instability with this type, apparently due to the greater capacitance between pins. As each socket is mounted, slip a couple of solder lugs, one at each end, between it and the underside of the chassis.

If you should happen to be using a steel chassis it would not be wise to rely on the connection made to the chassis by these solder lugs. The presence of lacquer or paint or, if the metal is cleaned, the tendency to rust, can prevent proper connection with serious results to the performance of the set. To avoid this it would be wise to connect all such lugs together with tinned copper wire (18 gauge is very suitable) running directly from point to point. An aluminium chassis does not suffer from such troubles and a firmly anchored solder lug should give no bother.

The remaining components are minor and do not call for any special comment.

With the IF's and sockets mounted you can commence the wiring, working from the circuit diagram or, if you have not quite mastered this yet, from the wiring diagram.

First connect the shield of both valve sockets to the earth lug at the end of the socket, earthing pins three and four (cathode and heater respectively) at the same time. 20 gauge tinned copper wire is best for this.

VOLTAGE TABLE

All readings referred to chassis.

Cathode (7) 6X4	215 volts.
Screen (3) 6BV7	180 volts.
Plate (2) 6BV7	200 volts.
Screen (1) 6BH5	90 volts.

Figures differ from last month's readings due to increased drain.

FILAMENT CIRCUIT

Next you can complete the filament circuit by running a lead from pin five of the 6BV7 socket to the same pin on the 6BH5 socket and thence to the 6AE8. This lead is of plastic hook-up wire and is most conveniently run along the rear edge of the chassis.

The following wires may be put in next and should all be of 20 gauge tinned copper wire. Pin 6 6BV7, to pin

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Watch this space next month for details of the revolutionary

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Regardless of make or price of pick-up, test the stylus for fore and aft movement. If there is any noticeable fore and aft movement, then considerable distortion will result, particularly towards the centre of a record.

Distortion will also arise on heavy string and brass passages and on vocal reproduction. A pick-up of this nature although termed and priced "High Fidelity", is in reality "High Futility".

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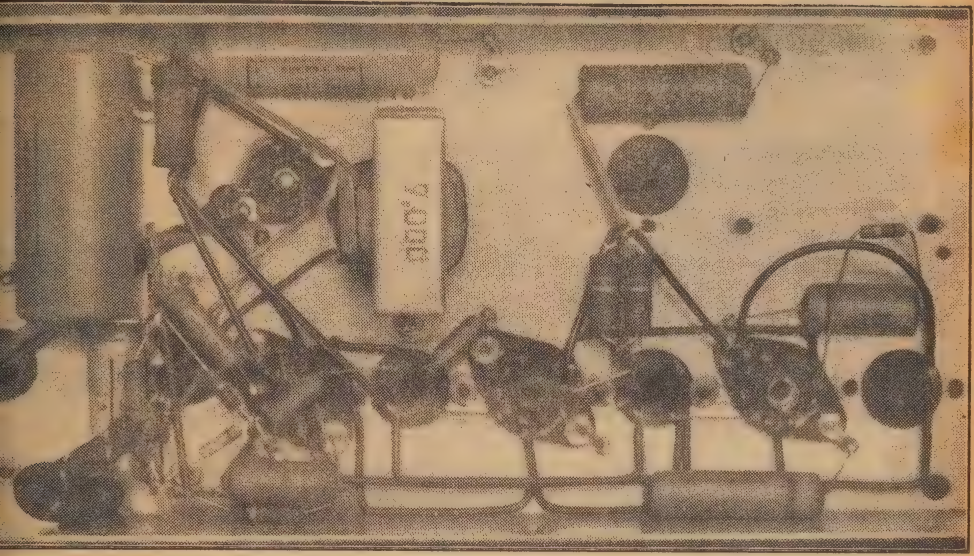


pare this underchassis picture with the diagram on page 67. With the exception of the AVC resistors most of the new components and wiring are on the right. Note the long pigtails on the temporary resistor on extreme right.

d IF. Pin 4 2nd IF, to pin 6 . Pin 2 6BH5, to pin 1 1st IF. 1st IF, to pin 6 6BH5. Most e remaining wiring at this stage e done with plastic hook-up wire. word of warning when soldering e lugs of the IF transformers. are moulded in a plastic having nt electrical characteristics but a low melting point. As a result, ossible to damage the coil if too heat is applied to the lugs while ing.

s does not mean that the lugs can- e soldered properly, but it does that rather more care than usual e necessary. The best plan appears to tin the lugs lightly before ing the coils, using a clean iron good quality cored solder. Altern- you can use a small amount of flux if you prefer, and this will o make a quick joint.

sparing with the solder, using nough to cover the lug without the hole. Otherwise you will trouble connecting some of the in a logical manner.

CAL PLACEMENT

ather critical part of the wiring AVC system, and in particular sistor network around pin 1 of 3V7. In addition to a 100 pf or from pin 6 there are three att resistors branching out from is is always a "hot" point in any d care must be taken with the if the risk of instability is to be d.

g leads from it must be avoided e resistors should each be mount- close to it as possible. Strange ay seem, the lead from the other the resistor is not at all critical nay be of any convenient length.

We don't propose to blind you with science as to why this is so; we imagine most beginners will be happy to take our word for it.

Incidentally, when soldering to short pigtails on small components care should be taken not to damage the component by excessive heat. Hold the pigtail with a pair of pliers between the spot being soldered and the body of the component, thus absorbing much of the heat in the metal pliers.

It is a good idea to "tin" the end of the pigtail and leave a small blob of solder on it before making the actual joint. If the lug to which it is to be joined is also tinned first, the joint can be made quickly and with a minimum of heat.

One of these three resistors goes to the remaining blank lug on the five terminal tag strip and it will be necessary to lift one end of the .01 mfd capacitor in order to terminate both it and the lead to complete the remainder of the AVC system.

PARTS LIST

- 1 Piece aluminium for chassis $7\frac{3}{4}$ x 9in x 16g.
- 1 Piece aluminium for V/C bracket $2\frac{7}{8}$in x $1\frac{1}{4}$in x 16 or 18g.
- 1 Power transformer 225V 50 mA 6.3V 2A Type PF201.
- 1 Oval loudspeaker type 4-5C.
- 1 Speaker transformer type EBG96.
- 1 6X4 valve.
- 1 6BV7 valve.
- 1 7 pin miniature wafer socket.
- 1 9 pin miniature wafer socket.

CAPACITORS

- 1 30 mfd 350 PV electrolytic.
- 1 25 mfd 40 PV electrolytic.
- 1 8 mfd 350 PV electrolytic.
- 1 .01 mfd 600V paper.
- 1 .005 mfd 600V paper.

RESISTORS

- 1 .5 meg. pot. with single pole switch.
- 1 .47 meg. $\frac{1}{2}$W.
- 1 4700 ohm $\frac{1}{2}$W.
- 1 1500 ohm 3W.
- 1 100 ohm $\frac{1}{2}$W.

MISCELLANEOUS

- 1 8 tag terminal strip.
- 2 5 tag terminal strips.
- 3 Grommets $\frac{3}{8}$in.
- 1 Grommet $\frac{1}{4}$in.
- 1 Knob type MV9.
- 20g tinned copper wire.
- 3 Core power flex.
- Hookup wire.
- 3 Pin plug.
- Nuts and bolts.

Additional parts required for this month's section

- 2 Midget IF transformers Nos. 1 and 2, types J32 and J33.
- 1 6BH5 valve.
- 1 6AE8 valve.
- 2 9 pin miniature wafer sockets.
- 1 4 tag terminal strip.

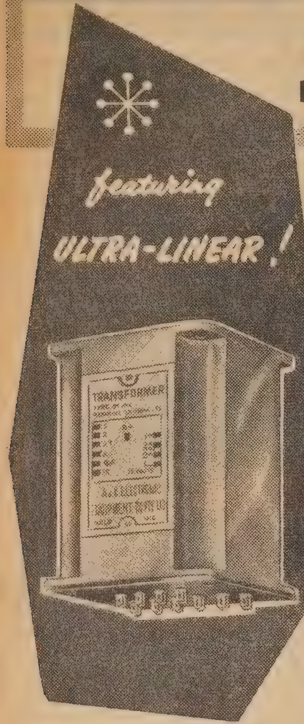
RESISTORS

- 1 1.8 meg $\frac{1}{2}$W.
- 2 1 meg $\frac{1}{2}$W.
- 1 .047 meg $\frac{1}{2}$W.
- 2 .022 meg 1W.

CAPACITORS

- 2 .1 mfd 400V paper.
- 1 .05 mfd 200V paper.
- 2 100 pf mica.

A&R Output Transformers



ULTRA LINEAR OUTPUT

TYPE 931-15: 20 watts.
Prim.: 4500 ohms P.P.
Sec.: 3.7 or 15 ohms.
Resp.: 10-60,000 cps.
Valves: EL37, KT66, 6L6, etc.
19% Screen Taps.

TYPE 931-8; 20 watts.
Prim.: as 931-15.
Sec.: 2 or 8 ohms.
Resp.: As 931-15.
Valves: As 931-15.
19% Screen Taps.

TYPE 921-15: 20 watts.
Prim.: 6600 ohms P.P.
Sec.: 3.7 or 15 ohms.
Resp.: 10-60,000 cps.
Valves: 807, KT66, etc.
19% Screen Taps.

TYPE 921-8: 20 watts.
Prim.: As for 921-15.
Sec.: 2 or 8 ohms.
Resp.: As 921-15.
Valves: As for 921-15.
19% Screen Taps.

TYPE 916-15: 12 watts.
Prim.: 8500 ohms P.P.
Sec.: 3.7 or 15 ohms.
Resp.: 10-50,000 cps.
Valves: 6BW6, 6V6, KT61, etc.
19% Screen Taps.

TYPE 916-8: 12 watts.
Prim.: As 916-15.
Sec.: 2 or 8 ohms.
Resp.: As for 916-15.
Valves: As for 916-15.
19% Screen Taps.

TYPE 949: 12 watts.
Prim.: 8000 ohms P.P.
Sec.: 2, 8, 12.5 and ohms.
Resp.: 10-50,000 cps.
Valves: 6V6, 6BW6, KT61, EL84, etc.
19% Screen Taps.

FOR MULLARD
"5-10" AMPLIFIE

TYPE 2505 — 12 wat
Prim.: 6000 ohms C.
Sec.: 3.7 or 15 ohms
Resp.: 10-50,000 cps.
Type 2505-8 for 2
ohms Sec.
Type 2505-15 for 3.
15 ohms Sec.

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1064 Hay St., Perth. **TAS.:** Homecrafts Pty. Ltd., 220 Elizabeth St., Hobart. **N.S.W.:**
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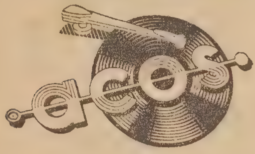

REPLACEMENT STYLI

There is a correct stylus for each type of Acos pickup. Ensure that these only are used as replacements. All Acos styli are manufactured to rigid specifications.

SB-1 for standard 78 r.p.m. records.
SB-2 for microgroove 33⅓/45 r.p.m. records. Use with Acos G.P.19, G.P.27, H.G.P.35, H.G.P.39, H.G.P.41 and H.G.P.45 cartridges.

SC-1 for standard 78 r.p.m. records.
SC-2 for microgroove 33⅓/45 records. Use with Acos G.P.25 and G.P.29 series turnover cartridges.

SD-1 for standard 78 r.p.m. records.
SD-2 for microgroove 33⅓/45 r.p.m. records. Use with Acos H.G.P.33 series turnover cartridges and with Acos H.G.P. 33⅓/Garrard and Acos H.G.P. 33⅓/Collaro replacement pick-up heads.

SE-1 for standard 78 r.p.m. records.
SE-2 for microgroove 33⅓/45 r.p.m. records. Use with Acos H.G.P.37 series turnover cartridges and with Acos H.G.P.37/Garrard and H.G.P. 37/Collaro replacement pick-up heads.

SK-1 for standard 78 r.p.m. records.
SK-2 for microgroove 33⅓/45 r.p.m. records. Use with Acos G.P.59 cartridges.

SL-1 for standard 78 r.p.m. records.
SL-2 for microgroove 33⅓/45 r.p.m. records. Use with Acos G.P.61 cartridges.

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Diamond Styli also available as follows:

SB1 Diamond SB2 " SE1 " SE2 "	Price: £9/15/- each

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88 Parramatta Road, Camperdown, Sydney, N.S.W. 'Phone LA 6124

Victorian Distributors: DISTRIBUTORS CORPORATION PTY. LTD., 403 Bourke St., Melbourne.

other tag strip is required, a four nal type, to accommodate the two meg. 1 watt resistors which form dropping resistor for the screens scillator plate. These are connect- parallel, making a .011 meg. two resistor. The connection to pin 6 1st IF is made with tinned copper

ne of the connections associated he converter valve and which will ally involve the aerial and oscil- coils will be of a temporary nature. is to enable the set to be tested present condition without the risk erloading the 6AE8 valve. In the building stage we will change these ctions to their final form.

e of these is the connection from mfd capacitor to the .011 meg ing resistor. In its final form it pick up this part of the circuit convenient lug on the oscillator meaning that the pigtail can then ortened somewhat.

ORARY CONNECTION

ilarly the .05 mfd AVC bypass ies a temporary position and the onnecting to the AVC line will no physical support at this stage. ugh not a thing to be encouraged permanent arrangement it is quite ler for a preliminary test. Leave gtails reasonably long at this stage.

other temporary lead is from the oscillator grid (pin 7) to the AVC At the moment it provides some n this grid until such time as the tor circuit is functioning and able nerate its own bias.

ally, the signal grid (pin 2) should e connected to the AVC line — temporarily — either directly or gh a resistor, the latter arrange- permitting a test signal to be fed grid of the 6AE8. The value of mporary resistor is not critical so ggest you use a .047 meg. ½W type, one of these will be required in ewhat different role next month.

the remainder of the wiring you l be able to work from the dia- . Check your work by referring circuit diagram, wiring diagram, hotographs. Incidentally, if you feel ou would like a clearer photograph we are able to reproduce on these you may care to purchase an al photograph. These are avail- hrough the query service, price 5/- 6in x 8in glossy print.

h everything complete and check- u should be able to switch on and some simple checks. It is easy whether the filaments are func- g; If all is well, the HT voltages also be checked. You will need er, but it is possible you may be o borrow one.

VOLTAGES

two voltages which concern us are to be found at either end of 11 meg. dropping resistor, mea- with respect to chassis in both At the HT end (pin 6 1st IF) it be between 190 and 200 volts the other end between 80 and 90 In the finished set these voltages ise slightly, due to the decreased of the 6AE8 when working cor-

At this stage the set could also be given a preliminary IF alignment, assuming the necessary gear to be available. If you can borrow a service oscillator or, more probably, find someone who will undertake this job for you, it would be an excellent method of checking that all is working correctly thus far, as well as ensuring that the channel is correctly adjusted. This will make things a good deal easier when the set is completed.

The next best thing to a signal generator would be something along the lines of the Radio Television and Hobbies "Signal Injector" (April, 1956). This produces a very broad signal, extending from the audio band, through the IF and broadcast bands, to the short wave bands, if required.

Even with this set to minimum output it will produce a solid signal in the speaker when connected to the 6AE8 signal grid, thus indicating that everything is functioning correctly.

The signal can also be used for alignment, even though it does not permit us to select the exact frequency to which the channel is adjusted. In practice this means that we would simply adjust all windings to the same frequency, even if we have no means of knowing exactly what this frequency is. Since the IF transformers are normally adjusted very close to frequency before they leave the factory this procedure will serve simply as a final "touch up."

OVAL SPEAKER

THERE appears to be some confusion over the speaker specified in last month's parts list as an oval 5C. Although originally carrying this type number we are now advised that it is to be known as a type 4-5C. There is also a type 4-5F which is similar physically, but having a higher efficiency. It could be used with this set if the higher price is not an objection.

Best results are obtained if the signal level is kept low and it will probably be sufficient to clip the prod of the injector to the body of the .047 meg, grid resistor, rather than to the grid pin. This will provide a capacitive coupling only, but one which should be quite adequate and allow better control of the signal level.

The windings are adjusted by engaging a non-metallic screw-driver in the slot provided in the core. A core can be seen when looking into either end of the transformer. The core is threaded and is moved into or out of the winding as it is rotated. A suitable screwdriver can be made from a length of plastic or bakelite rod by filing a suitable point on it. Even an old non-metallic knitting needle of heavy gauge will serve at a pinch.

Before moving any of the cores, mark the can in such a way as to indicate their original positions. Then, if things don't appear to be going according to plan you can reset things as they were before. In general, only a part of a turn should be necessary to produce a peak.

Which is just about all for this month. Next month we hope to describe the final stage.

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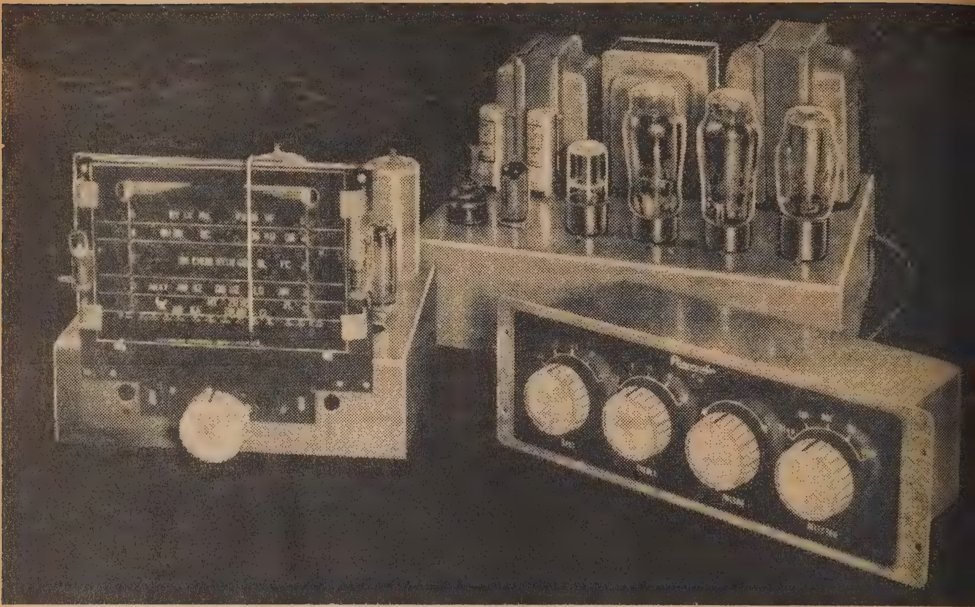
PLAYMASTER



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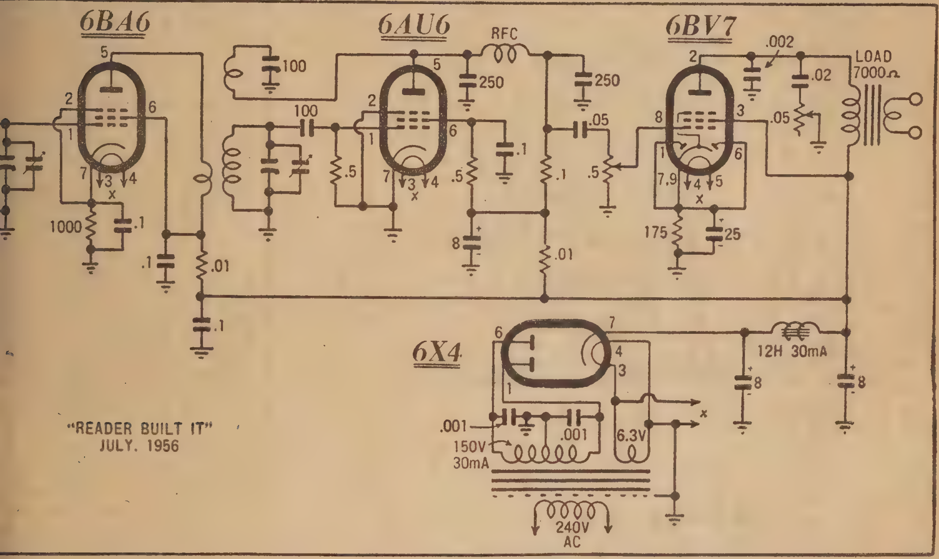
Gadgets and circuits which we have not actually tried out, but published for the general interest of beginners and experimenters.

ATURE DX RECEIVER HAS AN RF AMPLIFIER STAGE


6BA6
6AU6
6BV7
RFC
.002
LOAD
7000Ω
100
250
250
.02
.05
.05
.5
.5
.5
.1
.1
1000
.1
.1
.01
.01
.1
8
175
25
6X4
12H 30mA
8
8
.001
.001
150V
30mA
6.3V
240V
AC
"READER BUILT IT"
JULY. 1956

tages of an RF amplifier
in a small regenerative
r are increased gain, im-
selectivity and the fact
ne critical adjustments of
rector are isolated from
the aerial.

. COULSON, Marrickville,
, finds the above circuit an
over the "Miniature DX-er"
it is based.

can be adjusted with a two-
citor if the RF and detector
accurately matched. Alter-
separate capacitors could be
data given in the January,
, could be used as a basis
nents remembering that it is
to have more turns on the
e winding than the aerial coil.
g conditions for the 6BA6 do
arily make for optimum per-
and other readers may elect to
ble control. A cathode resistor
0 ohms could be returned to
a 20,000 ohm potentiometer.
of this pot. would go to earth
ther to the high tension line
50,000 ohm resistor.
ulson has made some modific-
the detector circuit and some
ay find that the regeneration
er with a 100 pF capacitor
6AU6 plate to earth.

SOCKET FOR DISPOSALS CR TUBE

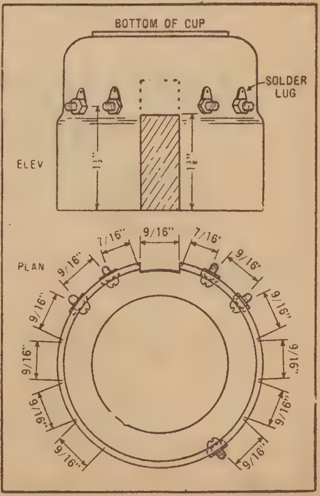
MR. P. HILL, of Terang, Victoria, suggests making a socket for cathode ray tube type VCR97 from a plastic cup of the type available from the chain stores.

Mr. Hill says: "Saw out the handle leaving a slot 9/16in wide and 1 3/8in high. Drill a series of 1/8in holes around the cup, the first 7/16in from the handle slot and then 9/16in between each subsequent hole, drilling six holes on each side of the handle slot. Each hole is 1½in from the top of the cup.

"Insert in each hole a 1/8in round head screw ½in long, the head inside the cup. Then fix a solder tag in the screw outside the cup and lock it with a 1/8in nut.

"The handle slot can be extended another ½in making 1 7/8in in all to take the whole of the key ridge on the side of the tube base. I sawed ½in off the key ridge to allow the cup to fit over the tube base without weakening the cup by making the handle slot ½in longer.

"Drill two holes in the cup bottom to fasten the cup to a suitable support."


BOTTOM OF CUP
SOLDER LUG
ELEV
PLAN
7/16"
9/16"
7/16"
9/16"
9/16"
9/16"
9/16"
9/16"
9/16"
9/16"
9/16"
9/16"
9/16"
9/16"

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TV INSTRUMEN

(Continued from page 38

cable between the probe tip and
strument in order to establish
capacitance.

Probes of both types can be a
existing oscilloscopes in order to
their usefulness.

The main difficulty is likely t
when a simple potentiometer-ty
control is employed, because the
shunt capacitance of the contr
following valve—and hence the fr
response characteristic — varies
position of the control.

The effect can be minimised
ploying a low resistance input p
meter, in which case the reactanc
stray capacities shunting the con
be made large, compared with th
ance of the control.

If you use a simple attenuator
the overall effect will be that n
much will be gained. With the
follower probe, on the other hand
put impedance can be made ve
and the variation in frequency
with gain control setting small.

Continuously variable gain
have been a traditional part o
oscilloscopes. The reason has b
it enables the operator to adjust
tern to fill the screen and hence
to best advantage any variations
undistorted sine wave. This wav
mainly used for audio testing,
with square waves of relatively
quency, when examining transi
low-frequency response.

The amplitude is traditionally
ed with a peak reading vacuum tu
meter, and, because of the simpl
of the waveform, there is little
ity as to the readings.

In television receiver testing si
ple waveforms are the exceptio
than the rule but, at the same
is desired to know their ampl
order to make comparison with
ed data.

MISLEADING READINGS

The conventional diode voltm
give the peak value, or the peak
value depending on the design
order to gain the required info
you need to be constantly refe
two instruments. A further disa
is that the conventional diode in
has a far from negligible loadi
on peaked waveforms.

Perhaps a better approach is t
the oscilloscope so that the volt
be read directly from the scree
cathode-ray tube. Appropriate sc
be engraved on a graticule p
front of the tube.

The accuracy of the system
the beam width being small,
of the vertical amplifier being st
the deflection sensitivity of the
ray tube remaining constant.

The overall error is likely
greater than the vacuum tube v
discounting loading effects, but
accuracy, which is quite good
for most work should be achiev
out too many elaborate precau
the design of the amplifier.

The vertical deflection system
oscilloscope can then be regard
vacuum tube voltmeter and, in
the horizontal gain control i

(Continued on page 101

ORE ABOUT MULTIPLE SPEAKERS

-quality multiple speaker ms are capable of excel- results but they are also expensive. This article dis- es ways and means of speakers in the lower-price bracket.

y be recalled that we presented original articles on multiple s and divider networks in the , 1955, issue.

use the basic theme at the time ality at any price" the discussion ited very largely to expensive d speakers having, in most cases, voice coils.

discussed the relative merits of ultiple speakers, then gave details ider network for 15 ohm circuits rossover frequency in the vicinity cps.

IDEA

the network, it was intended equencies below about 900 cps be fed to a speaker sufficiently nd well baffled to handle them. it typically be a true "woofer" or a general-purpose or wide- ype, having a sufficiently robust d suspension for good bass repro- .

uencies above about 900 cps were ed to a second speaker, generally than the first but more suited dling the middle and high fre- s.

de-luxe set-up we showed how a eaker could be added, normally al tweeter type, coupled to the high speaker through a suitable g capacitor.

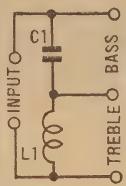
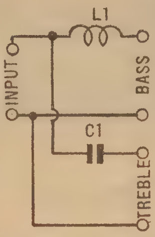
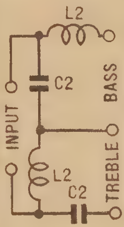
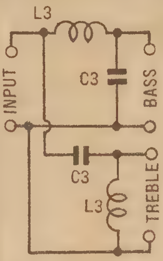
rence was made to various im- speakers but, irrespective of it was assumed that readers ching the matter on this plane be prepared to buy whatever s were recommended for the by their preferred manufac-

her, that details of the divider k, baffling, &c., might be varied orm to the manufacturer's litera- eaders interested in the subject at el would be well advised to refer these earlier articles.

NTAGES

use of two or three separate s in this general fashion has cer- dvantages. Perhaps the most s is that it broadens the apparent of sound and minimises the "hole wall" effect, which is often notice- ith a single speaker installation, larly in a heavily damped room. the same time there is a good of extending the range and g intermodulation effects in the rs themselves, resulting in better and definition.

s latter remark only holds good, rse, if comparison is made be- speakers of equal design merit. ould hardly expect a single high- unit to be bettered by a pair of routine speakers selling for a mere fraction of the price.

TYPE	SERIES	PARALLEL	GENERAL VALUES	VALUES FOR 15Ω SPEAKERS
¼ SECTION 6db PER OCTAVE			$L1 = \frac{Ro}{2\pi fc}$ $C1 = \frac{1}{2\pi fc Ro}$	L1 = 2.5mH C1 = 12uF CROSSOVER FREQ. 1000 c/s
½ SECTION 12db PER OCTAVE			$L2 = \frac{Ro}{2\sqrt{2}\pi fc}$ $C2 = \frac{\sqrt{2}}{2\pi fc Ro}$ $L3 = \frac{\sqrt{2} Ro}{2\pi fc}$ $C3 = \frac{1}{2\sqrt{2}\pi fc Ro}$	L2 = 2mH C2 = 16uF L3 = 4mH C3 = 8uF CROSSOVER FREQ. 800 c/s
WHERE L IS IN HENRYS – Ro IS SPEAKER IMP.– F IS IN FARADS – fc IS CROSSOVER FREQ.				

Reprinted from the October 1955 issue, this table shows the basic formulas for calculating values for L and C in quarter and half-section networks; also values for 15-ohm circuits giving a 900-cycle crossover. Half-section filters are generally preferred because they give a cleaner separation of sound sources and also protect the higher frequency speaker from heavy bass excitation.

Nor could one expect to improve the performance of a high quality unit by mating it with cheap eight-inch or five-inch speakers not intended for the job. It's pretty much a question of simple logic.

For many readers, however, it is quite out of the question to spend a small fortune on multiple high-quality speakers and it becomes a matter of doing one's best with available funds and resources.

It was only natural, therefore, that publication of the aforementioned articles in the October issue should have prompted quite a few inquiries from readers about the possibility of combining two or three speakers which they happened to have on hand.

As often as not the correspondent went on to mention that the speakers had different voice coil impedances. What could be done about it?

To such a question there can be no ready-made answer.

As a general rule one can only provide logical matching and divider networks if the speakers have the same order of voice coil impedance and the same order of sensitivity.

Theoretically, at least, it would be quite out of the question to use, say, a 2-ohm tweeter with a 15-ohm main speaker, or vice versa.

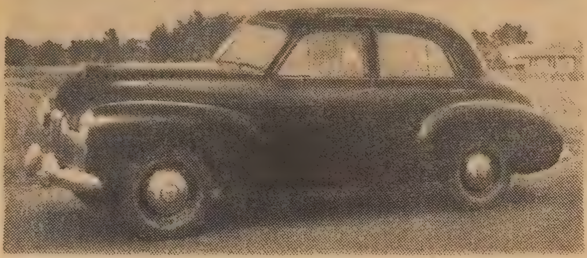
COULD POSSIBLY WORK

But no one could say that such a combination could not be made to work. It might easily be that a 2-ohm tweeter may exhibit a high impedance in the vital range and match a 15-ohm circuit tolerably well. Or perhaps a 15-ohm tweeter may be sensitive enough to work with a modest main speaker of markedly lower impedance.

The results may be quite good or quite hopeless with such random combinations, largely depending on circumstances—or luck, if you prefer it that way. In most cases it is simply a matter of "try it and see".

Another batch of inquiries came from

Only 70/- to Paint a Car



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It's so very easy to use. All you have to do is to clean your car thoroughly, then apply Sapphire. Just wipe it on with the special pad we supply free. Can be brushed on, too. Whether it's wiped on or brushed on, you won't get one single brushmark.

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The easiest of all enamels to use. One coat covers. No brushmarks. No spraying. No stripping. No streaks or lapmarks.

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"I purchased some of your Enamel two years ago, and I am very satisfied with same and the simple way to apply."

"I have used my tin of Dove Grey Sapphire Enamel on my car, and am delighted with the results."

Hundreds of written testimonials are available for inspection at our showrooms. If you're still sceptical, prove it yourself.

PROOF: Call in for FREE demonstration. You are under no obligation to purchase unless you are convinced that Sapphire is everything we claim. If unable to call, post coupon at once for your enamel.

MORE PROOF: Sapphire Enamel is guaranteed not to crack, chip, peel or fade for two years, or your money refunded in full.

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Grey Green.
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Russet Red.
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Light Blue.
Royal Blue.
Navy Blue.
Yellow.
Black.

readers who were intrigued by thought of multiple speakers but wa a 900-cycle crossover network to 2-ohm speakers instead of 15-ohm. reckoned that if two or three quality speakers were better than high-quality speaker, then the same should go for the more modest

In point of fact it does, but the vision of a 2-ohm divider netwo split the output between bass and m speakers is a tough one.

The basic formulas given in the ber issue and reprinted here as fig indicate why this is so.

TYPICAL VALUES

The values quoted in the right column are for 15-ohm speakers a will be noted that the capacitance required work out to 16, 12 or 8 depending on the configuration o filter circuit.

If one could simply specify "8 electrolytic" there would be no pro for electrolytics are small and rela cheap. Unfortunately, however, are not at all suitable for use in ci where only alternating potentials a volved or where accuracy is require

By and large, only paper capa can be considered seriously for quency dividing networks.

The 15-ohm case is awkward bu prohibitive. Assuming a half-se network to be desirable for reaso division between the speakers, use parallel arrangement allows the ca tance in each leg of the filter to be to 8 mfd.

But it will be obvious immed from the formulas that the capaci value varies inversely as the no impedance for which the filter is d ed. Thus, to produce the same filt an 8-ohm circuit would call for 16 of paper capacitors in each leg.

And for 2 ohms the figure would to near 60 mfd. In other words, isn't practical to produce such a using commonly-available compo Even if it were, the likely cost and plexity would be out of proporti the speakers available to use with

In the lower price bracket, ther more common practice is to have speaker handling all frequencies about 4Kc. Above this, output is d ed to a small tweeter speaker by w a suitably selected coupling capa Where possible the use of a full divider network is avoided, again interests of economy.

LOCAL SPEAKERS

Best-known local example of this tice is provided by the MSP Jensen involving a 12-ohm 12-inch speake the low and middle range and a 2 tweeter for the highs.

In the latest version of this pa 12-inch speaker has a deliberately cone, exhibiting a main resonan about 50 cps and a deliberate at tion of frequencies in the range the tweeter is operative.

The tweeter voice coil conne parallel with that of the main sp but a 1 or 2 mfd. series capacitor off the low frequency components impedance and sensitivity are so anced that it takes up where the speaker leaves off.

A crossover effect is thus obtai the 4Kc region, partly by elec partly by mechanical means.

tweeter, which is pictured else- in the trade pages, has recently iodified and now has an unper- housing behind the cone. This its characteristics slightly, but, nportant, protects the cone from ence by pressure waves from the eaker.

MSP pair may be operated in an y radio cabinet, but best results tained when the bass speaker is d in a suitably designed vented re.

tweeter may be mounted within x of the bass speaker if a single of sound is desired. Alternatively, be mounted elsewhere in the face baffle or on a separate small if a dispersed effect is required.

Rola Company have also released a five-inch high frequency , designated as type 5FX.

intended primarily to mate with of Rola 8M speakers and to in an ordinary radiogram cabinet. o eight-inch speakers handle the frequencies, while the 5FX s those above about 3000 cps. Its sed frequency range is 3000- cps.

UENCY DIVISION

he case of the Rola combination eakers have separate small output rmers and frequency division is plished partly by the characteris- f these transformers and by a g capacitor in the primary of the r circuit.

gnavox also have a tweeter speaker le which can be mated with other rs in their range to accomplish the same result as those previously ned.

ders who may plan to use one or or these speaker combinations are aced with any special problems, they will normally accept the acturer's recommendations regard- nnection and installation.

wever, the availability of these high ncy "tweeters" opens up interesting ilities for others who may want periment along more advanced While the speakers may not com- with the best imported tweeters are inexpensive and well within the of most enthusiasts.

of one or other of the tweeters permit a considerable improvement me systems.

GROUPS

saying this, we have in mind two ular groups of readers.

the first group are those readers at some time in the past, have an amplifier and installed a speaker was reckoned to be quite good day. Perhaps it is still too good scard but it lacks the top response is justified by modern recordings.

inexpensive tweeter, carrying the nse up to 10 or 12 Kc would wonders for the reproduction, both the point of view of response and lening of the sound source.

e second group of readers is right he other end of the scale. They the readers who bought early -range twin-cone speakers, who have ed to the wide response therefrom who may be wondering now how to t some further improvement.

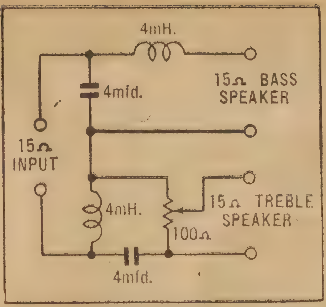


Figure 2: A half-section series network for 15-ohm speakers, designed to cross over at 4Kc. The output control on the treble speaker is useful for achieving balance, also for restricting treble response during poor programmes.

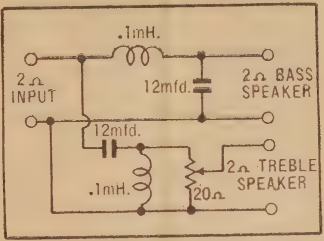


Figure 3: A half-section parallel network for 2-ohm speakers, also crossing over at 4Kc. Response curves for both networks are given on the next page.

is last remark may seem rather ge but, in some respects, single-unit wide-range speakers can be a mixed blessing.

The response is usually very wide but, because it is built in, one is "stuck with it". Reproduction may be excellent on good recordings but unpleasant on poor ones, where the wide range serves only to emphasise distortion.

Furthermore, there is some suspicion that multiple cone systems are prone to intermodulation effects which cause an "edgy" quality in some circumstances.

(It was to mitigate problems like these that we have described top-cut filter units, in past issues, which could be set according to the quality and nature of the programme material).

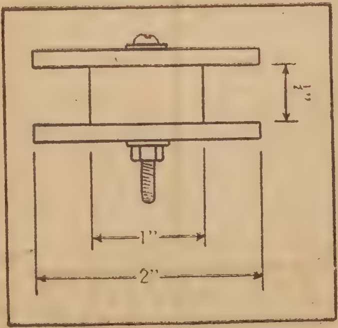


Figure 4: Details of the bobbin used for the inductors. It can be cut out with hand tools or better still, the cheeks can be turned with the aid of an electric drill held in a vise.

A better solution — and one which may now be preferred — is to use a separate tweeter speaker and a dividing network to supply the tweeter and also to keep the extreme treble out of the main speaker.

This arrangement allows the tweeter to be in or out of circuit as required.

In practice, the idea works out very nicely and a cross-over frequency of about 4Kc appears to be a good choice.

With the main and tweeter speakers in circuit, operating a foot or more apart, the sound source is noticeably broadened. The overall response may not be greatly affected—depending on the type of tweeter—but definition is generally better than from the less ambitious twin-cone speakers operating alone.

Switching out the tweeter leaves a response which tapers off above the cross-over point. With a half-section filter, the slope is not enough to produce an unpleasant ringing quality, though the upper register is removed very effectively.

LIMITED RESPONSE

In fact, a wide-range speaker is reduced to something that sounds very conventional indeed, and well suited to reproducing poor programs or old records.

It goes without saying that a network of the type envisaged, crossing over at 4Kc, is just what the other class of reader requires also — to operate a tweeter with an older type speaker.

Fortunately, the design of a cross-over network for 4000 cps is much simpler than one for 900 cps, as will be evident from the formulas of figure 1. As the cross-over frequency rises, the magnitude of L and C diminishes in proportion.

In the 15-ohm case it is possible to use a half-section series type filter which, according to textbooks on the subject, is the preferred type. In round figures, the requirements work out to capacitors of 4mfd and inductors of 0.4 mH, for a 4Kc cross-over.

The circuit and the constants are shown in figure 2.

TWEETER OUTPUT

It will be noted that the tweeter is shown as being fed through a 100-ohm tapped resistor, either a resistor with a sliding clip or a regular potentiometer. Main purpose of this component is to allow optimum balance to be struck between the tweeter and the main speaker.

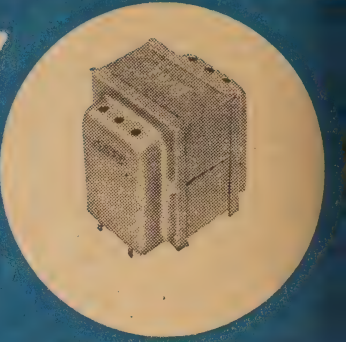
A tapped resistor could be built into the filter assembly, set as necessary, then forgotten. A switch in one voice coil lead could then serve to cut the tweeter in or out of circuit as required.

Alternatively, a potentiometer can be used (it may have to be specially ordered) and mounted so that its shaft is accessible.

Inductors of convenient size can be wound on the same bobbin as used in our previous voice-coil filter system. It has two 2in cheeks, attached to a 1in diameter centre bobbin. A brass bolt can be used through the centre, or a steel bolt, provided it is not larger than 1/8in diameter.

The bobbin can be cut from bakelite,

Ferguson



PREFERRED TRANSFORMER RANGE

POWER TRANSFORMERS FIRST PREFERENCE

CODE NO.	PRIMARY VOLTS	HTV Aside	HT MA	FILAMENTS
PF 130	230-240	285	100	6.3VCT/2A 6.3V/2A 5V/2A
PF 130F	230-240	285	100	6.3VCT/2A 6.3V/2A 5V/2A
PF 151	230-240	285	60	6.3V/2A 5V/2A
PF 151F	230-240	285	60	6.3V/2A 5V/2A
PF 152	230-240	285	125	6.3VCT/2A 6.3V/2A 5V/2A
PF 165	230-240	385	60	6.3V/2A 5V/2A
PF 170	230-240	285	80	6.3V/2A 6.3V/2A 5V/2A
PF 185	240	150	30	6.3V/2A
PF 201	240	225	50	6.3V/2A
PF 265	230-240	Secondary Volts		17 TAP 11.5, 10, 8.5/4.2A
PF 299	240	285	40	6.3V/2A 5V/2A

POWER TRANSFORMERS SECOND PREFERENCE

CODE NO.	PRIMARY VOLTS	HTV ASIDE	H.T. MA	FILAMENTS
PF 160	230-240	385	100	6.3V/2.5A 6.3V/2.5A 5V/2A
PF 164	230-240	325	100	6.3VCT/2A 6.3V/2A 5V/2A
PF 166	230-240	325	60	6.3V/2A 5V/2A
PF 168	230-240	385	80	6.3V/2A 6.3V/2A 5V/2A
PF 169	230-240	325	80	6.3V/2A 6.3V/2A 5V/2A
PF 173	230-240	425	175	6.3VCT/3A 6.3V/2A 5V/2A
PF 174	230-240	285	150	6.3VCT/2A 6.3V/2A 5V/2A
PF 175	230-240	385	150	6.3VCT/2A 6.3V/2A 5V/2A
PF 545	240	Ext. 1000	2	6.3V/3A 6.3V/6A
		350	20	4V TAP 2.5/2A
PF 439	240	32V	60	240-32 STEPDOWN

POWER CHOKES FIRST PREFERENCE

CODE No.	HY IND.	D.C. RES.	D.C. MA
CF 102	15	300	60
CF 103	30	420	60
CF 105	15	250	80
CF 109	20	225	150
CF 196	20	130	125

POWER CHOKES SECOND PREFERENCE

CODE No.	HY IND.	D.C. RES.	DC MA
CF 106	12	200	100
CF 111	16	165	200
CF 112	10	70	250

If you have difficulty obtaining regular supplies, contact us immediately.

OUTPUT TRANSFORMERS FIRST PREFERENCE

CODE NO.	WATTS	PRIM Z	SEC. Z.		RESPONSE
OP 9	15	10,000, 6600. 5000 PP	500, 250, 125		50-8000 C/S
OP 13	25	10,000, 6600. 5000 PP	500, 250, 125		50-8000 C/S
OP 24	5	5000 SE	8.4 OR 2.1		30-15,000 C/S
OP 25	15	10,000 PP	15-3.7 OR 8.4-2.1		20-30,000 C/S
OP 44	10	5000-2500 SE	500, 250, 125		50-8000 C/S
OP 54	10	5000-2500 SE	15, 12.5, 8.4, 6.5, 4, 3, 2.7 2.3, 2.		50-8000 C/S
OP 58	15	10,000, 6600. 5000 PP	15, 12.5, 8.4, 6.5, 4, 3, 2.7, 2.3, 2.		50-8000 C/S
OP 63	15	10,000 PP	15, 3.75		30-15,000 C/S
OP 112	6	10,000 PP	2, 8	SUIT ROLA 12 OX	40-12,000 C/S
OP 113	6	5000 SE	2, 8		40-12,000 C/S
OP 118	6	8000 PP	2, 8		40-12,000 C/S

OUTPUT TRANSFORMERS SECOND PREFERENCE

CODE NO.	WATTS	PRIM Z	SEC. Z	RESPONSE
OP8M	15	10,000 PP	500, 250, 160, 125, 100, 83.5, 7.5, 62.5, 55, 50	50-8000 C/S
OP 17	32	10,000, 6600, 5000 PP	500, 250,125	50-8000 C/S
OP 19A	15	5000 PP	12.5, 8, 2.3	30-15,000 C/S
OP 65	15	10,000 PP	8.4, 2.1	30-15,000 C/S
OP 67	15	5000 PP	15, 6.5	20-30,000 C/S
OP117	[illegible]	5000 PP	8, 2	40-12,000 C/S
OP119	6	6600 PP	2, 8	40-12,000 C/S
OP 60	32	10,000, 6600, 5000 PP	15, 12.5, 8.4, 6.5, 4, 3, 7., 2.7, 2.3, 2.	50-8000 C/S

VIBRATOR TRANSFORMERS FIRST PREFERENCE

CODE NO.	PRIM VOLTS	D.C. VOLTS	O'PUT MA	BUFFER FULL SEC.
VT 104	6	250	60	.004
VT 210	12	250	60	.006

VIBRATOR TRANSFORMERS SECOND PREFERENCE

CODE NO.	PRIM VOLTS	D.C. VOLTS	O'PUT MA	BUFFER FULL SEC.
VT 116	24	250	60	.005
VT 208	6	250	60	.01
VT 209	12	250	60	.08
VT 211	32	250	60	.005 ea. half

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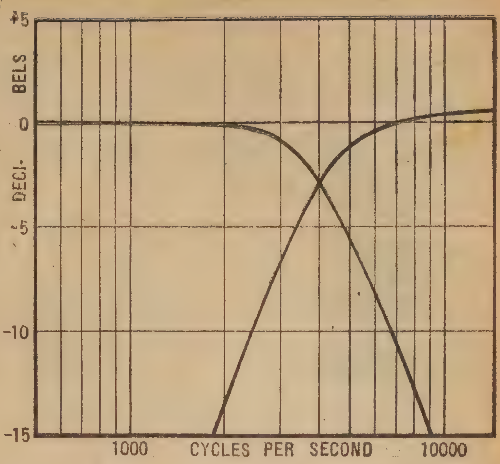
; plywood or other non- materials. One method is to cheeks out with a fretsaw and ouple of half-inch lengths from handle for the centre bobbin. newhat neater job can be done ng the parts a little oversize to vith, passing a bolt through the ole and spinning them down to h the aid of a file and an drill.

obbins can then be assembled ed slowly in a breast drill held se, while the wire is run on. slowly and carefully so as to smooth layer winding as far as . If the turns want to slip hree or four layers, run in a electrical tape to provide a new surface. A few jumbled turns outside won't matter.

Figure 5: Response curve of the 15-ohm network, taken with a medium quality amplifier and resistive loading across each circuit. With speaker loading, the shape of the curves may vary slightly and the crossover point may shift by a few hundred cycles. Much depends on the amplifier and speakers.



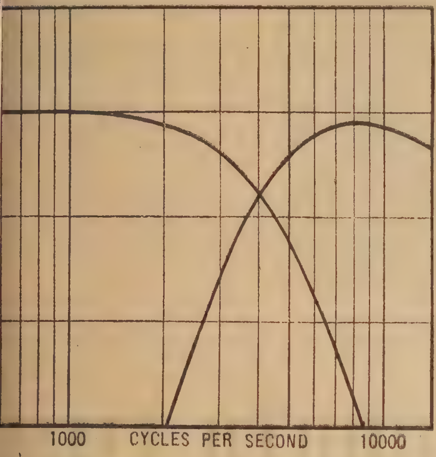


Figure 6: Here is the equivalent curve, taken with the 2-ohm network and into resistive loads. The slightly different shape may be accounted for partly by the different amplifier characteristics—2-ohm output instead of 15—and by the different configuration of the filter.

original coils in figure 2 each 15 turns of 22 B&S gauge led wire. A gauge either way 't make too much difference.

re 5 shows the response curve d with this network, operating a typical amplifier and into a 15-ohm resistors.

a 2-ohm network it is an advant- revert to the parallel connection er to avoid excessive values of ance. The relevant circuit is in figure 3.

again, we have provided an out- ntrol for the tweeter in the form 0-ohm tapped resistor.

AL VALUES

ou happen to be the meticulous on't be surprised if you find that ues shown don't quite check with mulas in figure 1. We deliber- wangled" the constants to use a ient value of capacitance and also mber of turns to bring the cross- 4 Kc.

2-ohm coils should be wound 5 turns of enamelled wire, either 20 B&S or 21 SWG.

response curve with this net- s shown in figure 6 — again with resistive loading.

the sake of completeness, we out a few extra figures cover- hm circuits.

arallel network would again ap- be the more convenient and. g to round figures, a workable 8-ohm network could be connected as per figure 3 but using 0.4 mH. inductors and 4 mfd. capacitors. The inductors are the same as specified for the 15-ohm series network.

To control tweeter output, a tapped resistor of from 50 to 75 ohms would be suitable.

In making up the networks, no special care is required with layout or shielding, since the circuitry is all at quite low impedance. However, there is every good reason to keep the construction compact and tidy.

It is usually sufficient to mount the components on a scrap of heavy ply, anchoring and marking the leads to avoid confusion at a later date.

Watch the connections carefully, particularly in the series network of figure 2.

The networks for 8 ohms and 2 ohms are parallel arrangements, which are not quite so tricky.

The 15-ohm network will allow you to use a tweeter with one of the many imported 15-ohm main speakers. If your speaker happens to be a highly sensitive wide-range type, then you will need something more ambitious in the way of a tweeter than the locally-made jobs mentioned earlier.

However, the MSP 6PU tweeter will work quite well with the older twin-cone speakers or general-purpose 15-ohm types which have good but not extreme sensitivity.

Using the 15-ohm filter, the 6PU types having a voice coil impedance pairs well with locally made 12in of from 12 ohms upward.

For speakers of still lower impedance, notably the many locally-made 2 ohm types, the 2-ohm filter would naturally be the one to use.

And just as naturally, the choice of tweeter would fall either to the Rola 5FX or the Magnavox twin-cone tweeter, both of which are readily available.

As regards these two speakers, we have not had the opportunity of conducting carefully controlled tests on their performance. We can therefore only offer comment based on first impressions, but which may be of some value.

The Rola speaker is credited by the manufacturers with a response to 10Kc though it naturally delivers output at reduced level much higher than this. If you want a top response which is "safe" but not spectacular, the Rola speaker would probably be preferred.

However, if you want as much treble as you can get for the money, you'll probably go for the Magnavox twin cone tweeter. But don't forget that extra top response from your speaker system will show up distortion which may be coming from a mediocre record, pickup or amplifier.

You may find extra use for the tweeter level control.

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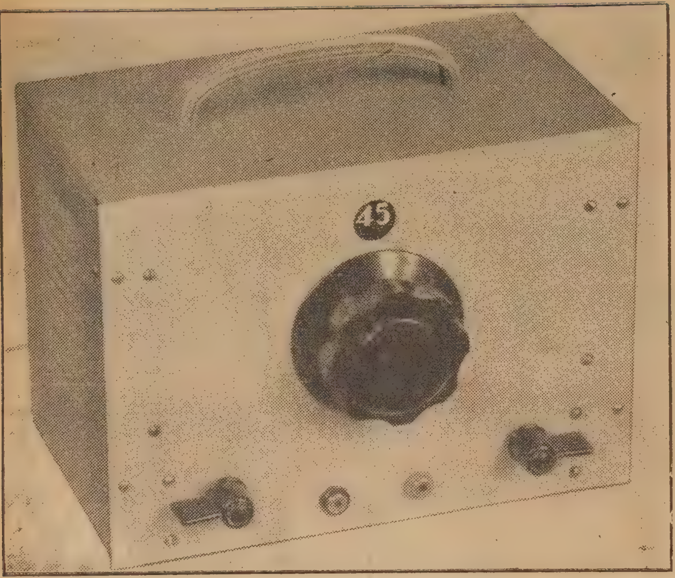


The finished timer housed in a standard Radio Television and Hobbies' instrument case. The large centre knob selects the times which appear as illuminated figures in the aperture above. The knob on the left is an "auto/manual" selector, and the one on the right the starting switch.

DESIGN FOR A PHOTO TIME

Here is something which our photographically-minded readers have wanted us to describ for a long time; a really accurate easy-to-use enlarging timer. It will save you time, minimis mistakes, and contribute much to the smooth working of your darkroom.

MOST of us commence our photographic career without too much thought about the finer points of timing. We usually beg or borrow some kind of clock or watch with a second hand and regard the problem as more or less solved.

Other adopt the technique of counting seconds, and there is no doubt that this is a very convenient arrangement if one can achieve the necessary skill. Unfortunately this is not easy unless one is working at the game all day and every day, and many an amateur's work suffers badly as a result.

IS IT ADEQUATE?

At first glance it might appear that manual timing with the aid of a watch or clock should fulfill all normal requirements and there may be some doubt whether anything more elaborate is justified. To clarify this point let us consider some of the disadvantages of the arrangement.

First, the matter of accuracy. There is little difficulty in securing perfectly adequate accuracy with a watch or clock, at least for times over three seconds, and provided the operator is able to devote his full time to the job of timing. This latter point is a major one, because there are often many reasons why it is not convenient to do this.

Foremost among these is the need for "dodging", or shading parts of the projected image to hold back exposure of the thinner portions of the negative and thus keep them within the limited tone range of the paper.

This is something which requires all one's concentration and which cannot be undertaken with any chance of success, if one has also to concentrate on the timing operation.

This is one reason why professional photographers develop the ability to count seconds accurately and, to a large extent automatically, so that they may devote most of their attention to whatever handwork has to be done.

It is also the reason why many enthusiasts develop mechanical timers which will sound an alarm at the end of a set period. This is better than having to watch a clock but there is still the human element and precious sec
can be lost reaching for the switch
the alarm sounds.

Another objection to manual ti
is that it would be hard to find
thing less suitable for darkroom use
the average watch or clock. The se
hand is usually an afterthought, occ
ing only a small area of the dial
often extremely difficult to read in
dim glow of a safelight. While wa
with sweep second hands are better
everyone is fortunate enough to po
one while, at the other end of the
we find dials calibrated in five se
steps only.

CHOOSING A "ZERO"

Again, there is the problem of s
ing a "zero" or reference mark
which to commence the timing cyc
one adheres to the conventional ze
the top of the dial there is the irrit
business of waiting for the hand to
around to this point every time an o
tion is to be commenced.

If, on the other hand, one select
nearest convenient calibration ma
order to save time there is alway
risk of becoming confused and fini
up with the wrong time or, at any
a doubt as to whether it was rig
wrong.

This confusion can be quite real
one is working in the dim atmosphe
a darkroom, particularly toward th
of a "session" when one's reaction
not as automatic as they might b

All of which adds up to the fac
if we can provide some form of auto
timing device which will carry ou
routine but rather demanding oper
we will remove a considerable load
the photographer's shoulders. He
be free during the exposure to "d
or "shade" as much as he likes or,
is not necessary, he may leave th
larger and attend to other matters
fident that no harm will be done
is not back immediately the ex
time has expired.

MANY ADVANTAGES

The overall result is a smoother
ing darkroom, with less wasted tim
wasted material due to timing
and a photographer free to conce
on the pictorial side of print prod

Having thus made a case for aut
timers in general we come to the pr
of producing a design which will b
to use, accurate in performance
satisfy all other normal darkroo
quirements.

The problem may be divided in
sections; first we must provide

nd reliable timing mechanism ving done this, we must then ne exact nature of the controls ith it.

ning for the moment that we r mechanism, what is the most nt form in which we can pre- controls? This question caused deal of thought and most mem- the staff, who dabble in photo- o a greater or lesser extent, had on the matter.

problem was whether the main ector should be a continuously control (such as a potentio- or a stepped control (such as a It was finally decided that a was to be preferred, mainly on e that it is much easier to set ed control with complete ac- than a continuously variable is is particularly so under dark- ghting conditions.

HER PROBLEM

having settled for a switch we ately encountered another prob- w to accommodate a sufficient of steps on a conventional While it would have been easy to provide an almost unlimited by means of a main selector in conjunction with a subsidiary er switch, this did not appear to ideal answer.

one, least of all professional aphers, liked the idea of having nd check more than one control. aid, in effect; "Give us a single which we can set quickly and ly to the time we require. We want anything which is in the mbiguous or likely to cause mis- y being overlooked."

seemed fair enough, but it did hat we were limited to 12 posi- d had to devise a scheme where- would cover an adequate range. led quite naturally to the ques- what order of increment should vided between each position.

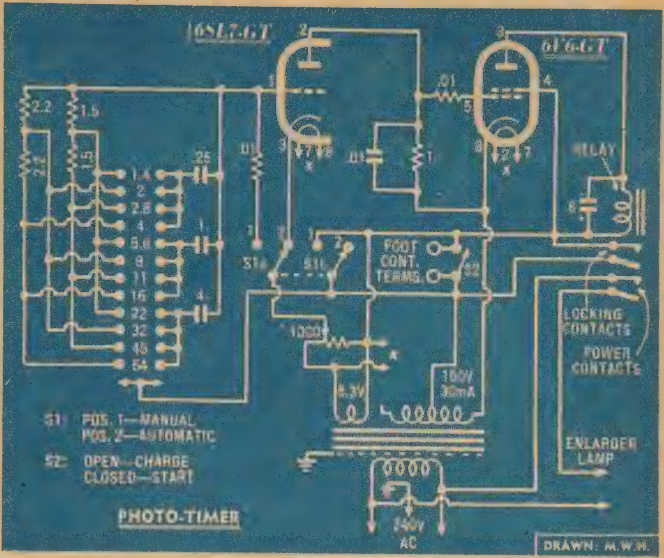
first point to appreciate is that not require a linear order of in- t. By linear, we mean a scale ncreases by, say, five second steps, 10, 15, 20, &c.

AL CASE

fallacy of such an arrangement ly evident if we stop to consider al case. A print which had been five second exposure and was ly much too light would prob- e corrected with a 10 second e, since the exposure time has oubled. However, a print made at onds, which was similarly under- l, could obviously not be cor- by a five second increase. It also require double the time, i.e., conds to provide the same order ease.

it is clear that what we require le which increases by some select- or, such as the two times in the e quoted. But whether a factor is really suitable is another mat- d we have to decide just how e need to make the increment in o suit all likely conditions, re- ring that the smaller we make smaller will be the range which accommodated by 12 positions.

A PREVIEW — THE FINAL CIRCUIT



Next month we will describe a practical instrument designed around this circuit. In the meantime a comparision between it and the simplified circuit will show how various refinements have been added. The use of a switch giving time intervals suitable for photographic work makes the device far more convenient to use than one having more settings but not related to photographic requirements.

Drawing on our own practical experience in making test strips, we recalled that we usually separated these by a factor of two when working with normal grades of paper, reducing it to about 1.5 when working with contrasting grades. This seemed adequate, because it was seldom that we could not produce a satisfactory print with one of the chosen times.

DIAPHRAGM

This was without introducing any other variables, but there is at least one, the diaphragm setting, which could also be used in a sticky case. It is worth appreciating that a factor of two is identical with a change of one stop in the diaphragm setting.

It seemed that what we wanted was a scale in which every step would represent a change of 1.5 times and ideally, every second step a change of two times. But such a scale is virtually impossible if every step is to maintain the correct relationship to its neighbors. For example, a setting of 1.5 seconds multiplied by a factor of 1.5 gives, not two, but 2.25.

But the factor did not have to be exactly 1.5. It could just as easily be 1.4. And 1.4 times 1.4 (1.414 more correctly) is two. Working on this basis we produced a scale having some unique features.

First we were able to provide a range covering from 1.4 to 64 seconds in 12 steps and this should be adequate for all normal enlarging work. Shorter times are very unlikely and, if they consistently occur, they indicate something wrong with the negatives or the need to use a smaller enlarging lamp.

Longer times may occasionally be called for and they can be accommodated relatively easily by simply repeating the exposure. If you should have different ideas regarding either end of the scale you can easily drop one or two positions from one end and add new ones at the other end.

The scale provides increments of 1.4 times starting from any chosen figure or, similarly, of two times starting from any chosen figure. In the latter case every second position only is used.

This also means that, while we may require increments of two times, we still have a choice of starting points which are separated by a factor of only 1.4.

DIAPHRAGM FIGURES?

The figures on the resulting scale bear a striking resemblance to the figures on the diaphragm of your camera, but this is more coincidence than anything else, and the two meanings must not be confused. Stop numbers represent a doubling of exposure, because increasing the lens diameter 1.4 times doubles the area of the lens in use, and thereby doubles the light falling on the film. On the other hand, increasing the exposure time by 1.4 only increases the available light 1.4 times. In the first case the increase is a square function, in the second a linear function.

The scale we have selected has another advantage. The increase represents an exponential function. The dis-

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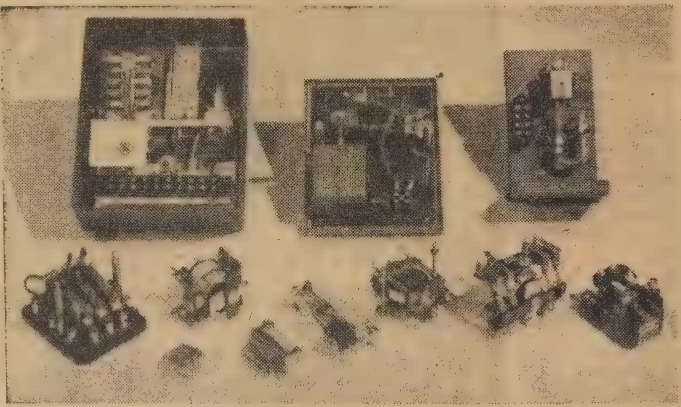

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58 HIGH ST., GLEN IRIS, SE6, VIC.

: cürve of a capacitor is also an ential function, so that the re- in the timing circuit will increase y. This means in practice that nient values can be used.

the present instrument a capacitor nfd, and a resistance of 4.4 meg. the longest required time interval, y 64 seconds. One half of this re- :e will give 32 seconds. 3 meg. the same amount of capacitance 45 seconds, and one half of this econds.

lucing the resistance in this fashion ive us all the required intervals. ver, each step requires one resistor, his may result in non-standard being called for. Reducing the tance in the circuit has exactly the effect, so that if we divide the range hree sections of 4 steps each, we only four resistors and three itors, or seven critical components ld. It is easy enough to combine quired values of R and C by means itching.

ER FACILITIES

ler suggestions regarding the facili- hich should be made available in- l the provision of a manual switch ow the enlarger lamp to be energised etting up and focusing, and a pair rminals to allow the starting cir- o be extended to a foot switch.

ving thus disposed of the controls actorily we had next to consider ctual method of achieving the re- l times. Needless to say, a high of accuracy is a prime require- at least to the extent that any n time should always be the same, if it differs by a few percent from ominal time indicated. In other repetitive accuracy is more im- nt than absolute accuracy.

matters comparatively little, if the operates for 12 seconds, although alibrated for 11, provided that the is perfectly constant, and the timer rovide this interval over any num- timing cycles. If, however, good te accuracy is also possible, so the better.

ctronic timers usually make use fact that a capacitor takes a cer- ime to charge or to discharge h a resistor. If a capacitor is d from a high voltage source, then d to discharge through a resistor, ltage across is will fall in the man- dicated by figure 1.

nly remains to utilise this change tage to activate some kind of a l circuit.

NG BIAS

know, for instance, that a change l voltage of a valve will cause a in plate current. It is thus pos- to connect a suitable RC com- n to the grid of the valve, a high negative charge on the capacitor vely preventing the flow of plate t.

en the charge leaks away through esistor, the grid become less and egative, ultimately reaching a point plate current commences to flow. e grid becomes even less negative, late current increases, until it s a value where it is capable of

TYPICAL R/C DISCHARGE CURVE

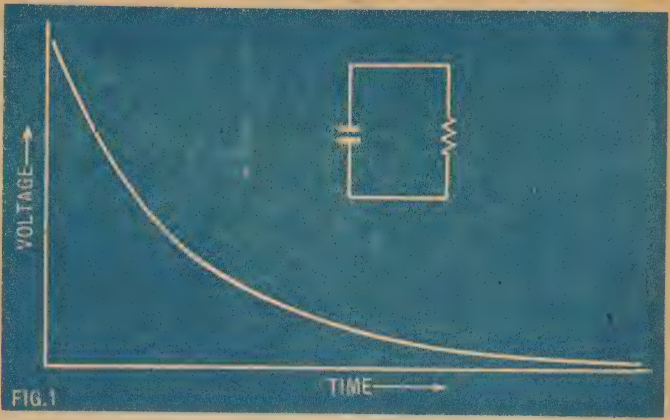

FIG.1

The curve shows quite clearly how the rate of discharge varies throughout the discharge cycle. The rate of change near the extreme end of the cycle is too slow for practical use, but the circuit described extends the useful portion of the curve considerably.

operating a relay connected in the plate circuit.

However, it will be apparent from ordinary valve characteristics that any such change in plate current must be relatively gradual and that somewhere along the upward slope, the relay will operate.

But relays are very ordinary devices, mechanically, and there is no guarantee that any given relay will close each time with precisely the same amount of current passing through it. Obviously enough, any uncertainty about the closure of the relay must nullify care which may have been taken with the R/C network in the valve's grid circuit.

Thyratrons, or gas valves, are much better in this respect, because the change from non-conduction to conduction occurs abruptly, ensuring reliable operation of the relay.

The trouble is that the trigger voltage, at which the change in state occurs, can vary over a considerable range, due partly to inherent characteristics of the valve, and partly to the influence of heat and light upon ionisation conditions within the valve.

Mains voltage variations can also considerably upset the characteristics of gas valves.

Thus, although such circuits have been used, they are suspect as far as repetitive accuracy is concerned. And, by the time precautions have been taken against instability, the circuits may well have become unwieldy.

☆

This simplified circuit should be followed in conjunction with the explanatory text. Main feature is the method of direct coupling whereby each valve operates on alternate half cycles. The capacitor C2, acquires a charge during the 6SL7's active half cycle which is used to bias the 6V6 during its active half cycle. With starting switch open valves are in series. Rectified current through them is used to charge capacitor C.

☆

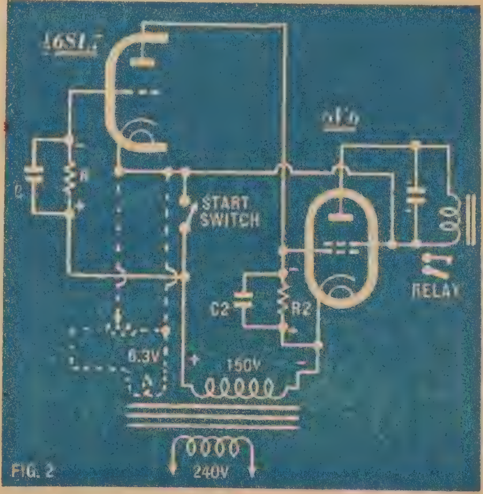

FIG. 2

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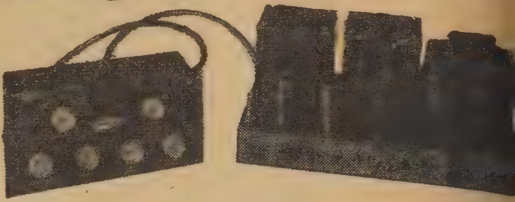

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athode trigger tubes with highly
igger voltages overcome some
lifficulties outlined above, but
unfortunately rather expensive.
ous discharge valves are to be
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vill become clear if one con-
ıt, while the terminal voltage is
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nt also must drop, because the
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20 to 170 will occupy much less
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infinitely long period. However,
of immediate interest to us in
timing circuits.

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use the high rate of discharge
early part of the discharge
ıt if we do this, we find that a
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UITABLE

of these arrangements is very
. Higher voltages make for a
tly unit and call for various pre-
to avoid flashover and break-
Larger values of capacitance are
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for most times, even when we
major portion of the discharge

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hich would be called for) create
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normally acceptable in the grid
of a valve and can lead to un-
operation. Second, such values
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of the capacitor, particularly a
e, as it would have to be.

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along with all the other pre-
which must go with high resist-
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finally, there is the question of
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can make some arrangements
re a sharp change in plate cur-
en though the rate of change
voltage be slow, it becomes per-
to operate on the flatter portion of the discharge curve, thereby achieving reliable operation for long periods with much lower values of R and C, than would otherwise be necessary.

LACK OF GAIN

While the use of a single valve with the resistor/capacitor combination in its grid circuit and the relay in its plate circuit will provide some amplification of the rate of change, this is not nearly enough to ensure reliable operation.

However, if we provide a second stage (i.e., another valve) we can easily increase the rate of change to the point where it is capable of giving perfectly reliable operation.

Since we are dealing with such a slow rate of change the signal is, for all practical purposes, a DC one and the two stages must therefore be direct coupled. We also have to make provision to charge the resistor/capacitor network prior to initiating a timing cycle.

The circuit we finally chose is by no means original and has been used in a number of commercial and industrial timing circuits. Our main job was to adapt it to our particular requirements and the available valves and other components.

We also had to work out how it functioned!

A simplified circuit is shown in fig. 2 and we will base our explanation on this. R and C are the components of the time determining network, the 6SL7 may be regarded as an amplifying valve, and the 6V6 as the relay control valve.

First, let us consider the conditions with the start switch open. Also, let us assume that at this particular instant the 150 volt transformer winding has a polarity as shown. Now let us trace the electron flow commencing at the negative terminal of the transformer.

From here we go to the cathode of the 6V6 and thence to the screen and plate. At this stage there is no bias on the grid of the 6V6 and the grid has no effect on the electron stream. From the screen/plate circuit we go to the cathode of the 6SL7 and these two valves may be regarded as being in series.

The plate of the 6SL7 plays no part in the circuit at this stage but the grid is returned to the positive side of the transformer. Thus our path is from the cathode of the 6SL7 to the grid, then through R and back to the transformer.

CHARGING C

The effect of this electron flow is to develop a voltage across R (and C) having the polarity shown. The positive voltage applied to the 6SL7 grid will be reduced by this amount. Because of the presence of C the full voltage possible may not be developed across R immediately, but will have to wait until C is fully charged. This may take several cycles of the polarity we are considering.

During the negative cycle, when there is no electron flow, the charge acquired by C tends to keep the voltage across R constant. However, the voltage will drop slightly as the charge leaks away through R and must be restored on the next positive cycle.

(Continued on Page 123)

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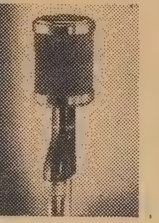

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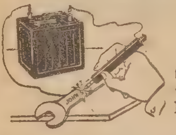

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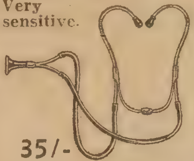

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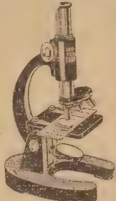

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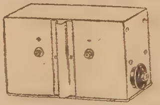

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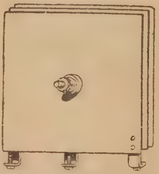

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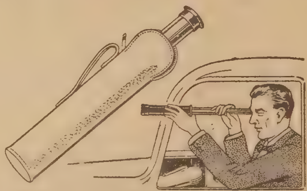

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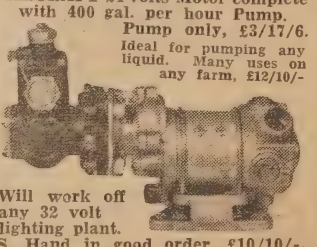

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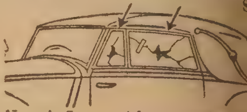

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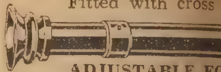

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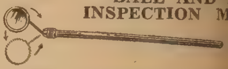

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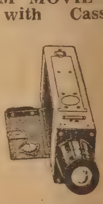

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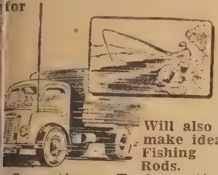

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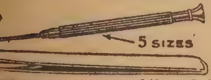

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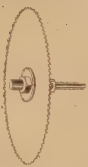

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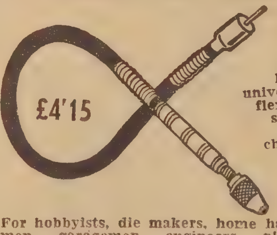

44in long, universal flexible shaft, ¼in chuck.

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Ideal for Fox or Rabbit Shooting.

6 Volt, 90/-; 12 Volt, 95/-.
Complete with Switch and Flex.

Here's your answer, Tom!

Believe it or not, all the questions in this month's "Answer Tom" article came from the reader. His thirst for information takes us over a number of fields from crystal radio ceivers to transistors and on to the theory of movie cameras. When this particular "To is a few years older we imagine that he will become a very versatile man.

THERE is nothing completely new under the sun and it may be that some of the queries in this month's instalment have appeared before in slightly different form. However, we are sure that in going over the same ground again, we have managed to glean some new and valuable pieces of knowledge.

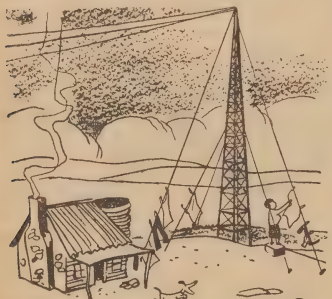
What type of aerial would collect the most signal? I am thinking of a crystal receiver?

Well, Tom, if you are really going for the ultimate in performance, you would erect an aerial something like the broadcast station uses for transmission.

You would probably end up with a tower some hundreds of feet high, and we imagine that the bill from the contracting and rigging firm for the construction of such an aerial, would be somewhat out of proportion to the crystal set project.

Simple resonant aerials, as are used at high frequencies, are also usually too big for convenient installation at broadcast band frequencies.

Our standard recommendation for crystal set owners is that they choose a pair of supports, as high as possible, and up to about 50 feet apart. An insulator is tied to the most distant support, and the aerial run between this insulator and another similar insulator at the nearest support. A length of insulated wire is soldered to the aerial close to the nearest insulator, and run down to the receiver aerial terminal.



". . . Out of proportion to the crystal set."

This latter wire may be 30 or 40 feet long if need be, and the reason for the insulation is to prevent losses if the wire should touch metal parts of the building, such as roofs, gutters or window frames.

A crystal set should always be used with an earth wire and this wire should take the most direct route from the receiver's earth terminal to the nearest water pipe or metal buried in the ground, if a convenient water pipe is unavailable.

How thick should an aerial for a crystal set be to avoid losses?

We have not had any opportunity to undertake detailed experiments or check the literature to determine the relationship between the thickness of receiving aerials and their efficiency, but available evidence suggests that the thickness of an aerial does not make very much difference to its efficiency when used for a reception at broadcast frequencies.

In other words, Tom, the gauge of wire you use for your crystal set aerial will be determined more by the mechanical strength required for it to stand the strain of winds, movement of support poles, not to mention any stray birds which may choose your particular aerial for a resting place.

In the old days experimenters made a great point of using special wire for their aerials. We have heard of copper wire being specially silver-plated and regularly polished, with the idea of obtaining improved performance. In actual fact, we do not think the difference between the silver-plated aerial and an aerial made from ordinary mild steel fencing wire, would be appreciable.

It is quite a different matter when a high power transmitting aerial is involved, especially at high frequencies when the current flows close to the surface of the wire. The losses of the conducting material may then be appreciable, but this is not likely to concern you right at the moment.

What material is best to use as an insulator for an aerial?

It is a bit hard Tom, to answer that one directly. We will have to follow the footsteps of the Knights of old and parry it as one would do some of their grisly weapons.

First of all, the material must have good electrical insulating properties. Secondly, it must be able to support the weight of the wires. At the same time, there is no point in choosing the material with the ultimate in insulating qualities if it retains dirt and moisture on the surface, and the current can escape in this way.

In practice, various types of ceramics appear to be satisfactory. The specific resistance is very high, the mechanical strength, particularly in compression is also very good, and the surfa easily be glazed so that it does lect moisture and other contam which spoil the properties of an or.

Porcelain "egg" type insulators quently used for broadcast aerials. With this design the is under compression and even break or crack, the aerial would supported.

Insulators of similar design made from polystyrene. They are er than the glazed type, but th surface may tend to be conta more quickly. Despite this they a factory for most receiving aeria

For temporary installations menters often use wooden in These are good when dry but moisture easily, making the properties rather poor. The diffic often be overcome satisfactorily ing wooden insulators in paraffi

". . . Fancy being clouted half a bottle."

We've also heard of insulato made from bottles — the old-st drink bottles with a deep groove the neck. The surface is good, sulating properties excellent wouldn't be too happy about the ity of the arrangement.

Fancy being clouted with half at the end of a broken aerial.

Should headphones be wi parallel or series?

This Tom is one of those thin which you can make your own with a little help from us, of There are arguments for wi phones, either way, depending particular requirements.

Perhaps the position would b if we give you a specific exampl each individual headphone has ınce of 1000 ohms. If the two are connected in series, the total e will be 2000 ohms, but if they nected in parallel the effective e will be only 500 ohms.

ı wish to connect to a set which est with an impedance around ms, then the answer is obvious. r remark applies to the 500-ohm

u buy them, headphones normloy the series connection. In this ey are best suited for connection into the plate circuit of small r valves, which need a high load ıce for best results.

lel connection would work best where the phones are fed from own transformer of one kind or

SALS PHONES

impedance ex-disposals phones pecial case. These usually have ow impedance and even when ed in series, only make up about ns. They were always fed, in miliar, from step-down transformers thicker wire used in winding vas an insurance against failure himidity, handling, &c.

worth bearing in mind that the ce of phones as measured on an y ohmmeter is only a general o the impedance, since the latter up of the resistances and an inelement effectively in series.

simple instruments it is not easy sure the impedance, but ordinary hm headphones could easily have edance of anything from 10,000 o 20,000 ohms at particular fres.

performances of the valve in re- power output and distortion den this latter figure. However, there oint in being too critical, because ones require a very small amount er for their operation, and in most the fidelity is not really good for the small amount of additionortion added by the valve to be considering.

um up, if you are re-wiring a pair nes to use with a small receiver, ost all cases it would be best to t them in series.

ill transistors be used in place alves in transmitters?

actual fact, Tom, they already Over the past year or two, several nental transmitters, using tranhave been described in the techournals. However, transistors have ber of serious limitations, which it possible to use them in only a ecial applications.

most obvious limitation is the um power input. The biggest tors available so far, to the exnters, are capable of handling only watts, whereas for worthwhile ge, in most transmitter applicathe power required is many watts. ateur transmitters, for example, by comparison with the general transmission equipment, operate at inputs up to 100 watts in this y. Overseas, amateur transmitters 1000 watts are common. Then 1000 watts is more or less "flea" when it comes to a broadcast itter, where 10,000 watts or even 0 watts installation are not unon.

second serious limitation of transistors is the maximum frequency at which they will operate. The performance of available transistors deteriorates seriously at frequencies above a few hundred kilocycles.

The best of them will operate with reasonable efficiency on the 80 metre amateur band but are more or less useless for radio frequency work on any of the higher bands. The transmitters so far described have operated around about this frequency with an output of only a few milliwatts.

On the other hand we envisage that transistors will help the broadcast engineer considerably in many applications. One that comes to mind immediately is the case of the outside broadcast amplifier, which is required often to have high gain and work from a compact battery supply. Transistors make possible a power supply consisting of a few dry cells, where previously a large and expensive high tension battery or vibrator supply was required.

The small size is of great help when the engineers have to handle broadcasts of sports events, etc., at short notice, when no studio facilities are available. They appear to have very long life, and stand up to vibration and shock very well.

Transistors have many applications where they can do the job better than valves and, in fact, there are still other applications where transistors can be used, and where valves would be quite impossible.

On the other hand there are plenty of applications where we cannot see transistors replacing valves for many a long day, if ever.

Is it possible to tune a transmitter without the use of a variable capacitor? If so, how is this done?

Yes, Tom, it certainly is possible to tune a transmitter without using a tuning capacitor and, in fact, it is often convenient to omit the variable capacitor.

A tuned circuit consists essentially of two items, these being a capacitor and an inductor. In the case of a fixed tuned circuit, both may be fixed. If you wish to vary the natural resonant frequency of the circuit, you can do so by either varying the capacitor or the inductor, or both together.

You are already familiar with the construction of the variable capacitors used in receivers. Variable inductors for receivers usually consist of a coil of wire in which a high permeability slug is moved. With the slug removed from the coil, the inductance is a minimum. It increases as the slug is moved into the coil and reaches a maximum, when the slug is approximately in the centre of the coil.

In the case of variable inductors for transmitters the power lost due to the imperfections of the slug, be it iron dust or special ferrite material, is often too high, and a large diameter coil with provision for shorting out or disconnecting some of the turns, either by means of a switch or a continuous roller, may be more desirable.

Yet another method often used is to provide two coils, one variable in relation to the other, so that the mutual inductance between them causes the total inductance to be high when the coils are aiding and low when the coils are opposing each other.

This method was a favorite with the engineers many years ago, when most transmitters operated on very low fre-

(Continued on page 90.)

The RADIOMASTER

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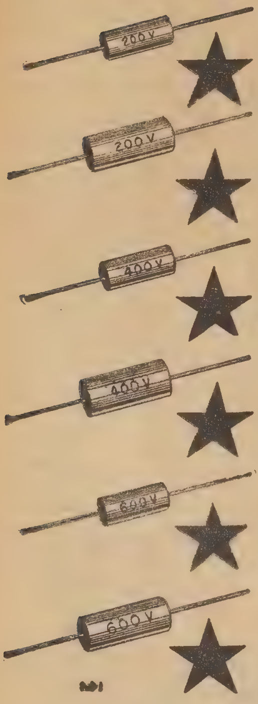

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quencies. It has also often been usec receivers. A case in point is the Ma box Crystal Receiver which was desc in the March issue of this year.

Is it possible to run a mov camera dead slow and still obta satisfactory pictures?

This one is a little bit off our but perhaps we can give a good en answer to satisfy your curiosity for moment.

Motion pictures depend for their eration on a peculiar characteristi the human eye. There are all sort long technical words to describe this of thing, but we don't know very n about the phenomena in those terms, it probably would not help the expl tion a great deal.

The simple facts are these; if a ture is flashed on the screen for 1/100th part of a second, the eye, b or some other part of the hu anatomy with a long name, will re the picture for a longer period. For people this period may be about 1/ of a second.

APPEARS STATIONARY

If therefore, the same picture is fl ed on the screen for 1/100th part second, at the rate of 25 times each ond, the picture will appear statio and continuous to the human eye.

In motion pictures each successive ture or frame is slightly different. A n ing film of a man walking down street would show successive pict with his legs advanced a few inc When the picture is projected he app to be walking continuously and smoot

If the movie camera, taking the ture of the same man, were run very low speed, taking say, five pict per second, and then projected at same slow speed, his movements w appear as a series of jerks.

On the other hand, if it were proje at the normal speed of about 24 fra per second, he would appear to be w ing at about five times his normal sp

You will almost certainly have seen effect of this speed-up at your local ture theatre, when some of the old films are projected on modern eq ment. These films were usually take about 16 frames per second and characters appear to do all sorts ridiculous things because of the sp up to 24 frames per second.

You will also probably have seen reverse effect when the camera is sp ed-up and the resulting film projecte normal speed. In this case the sub appears to be moving more slowly normally, and allows the viewer to amine the action of a racehorse, or thing else which happens too fast to examined in detail normally.

COACH WHEELS

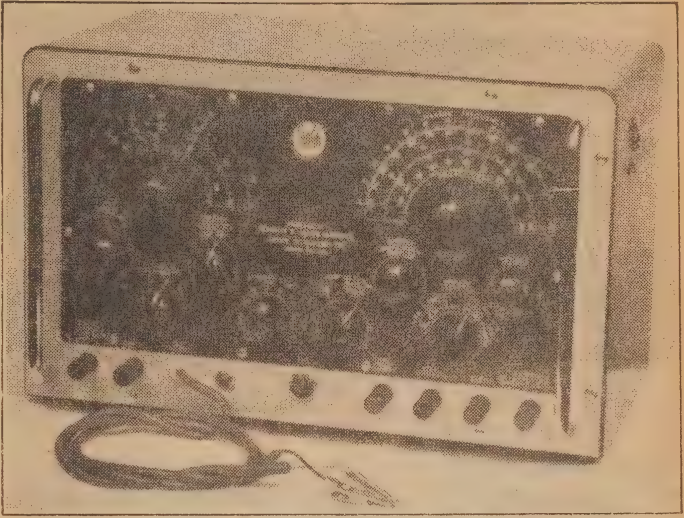
Also, as a matter of interest, it plains why the wheels of the s coach, drawn by bolting horses pursued by the gallant hero, ap to go backward — or even ren stationary.

It frequently happens that, as frame is exposed, the spokes of wheel occupy the same relative p tions as they did when the prev frame was exposed. When projec we see a succession of pictures having the same spoke structure, creating the illusion that the w is stationary or only moving slowl

RADE REVIEWS AND RELEASES

E LATEST COSSOR SWEEP AND MARKER GENERATOR

ressly designed for the visual nment of television receivers :onjunction with a cathode oscilloscope, the Cossor del 1232A "Telecheck and ker Generator" is a versatile quality instrument.



instrument generates a carrier ich can be frequency modulated. rrier is fed into the radio-fre- amplifier to be tested while the of the amplifier is fed to the ver- nplifier of an oscilloscope.

ne same time, the horizontal am- of the oscilloscope is intercon- with the generator in such a way e deviation of the spot on the is proportional to the frequency n of the carrier.

SPONSE CURVE

result is a direct display of the e curve of the amplifier under the screen of the oscilloscope.

p alignment methods allow the e to be monitored continuously y defect will be apparent without ity. Further, it makes possible nt of the receiver even if the instructions are not available.

Cossor 1323A has four output being: 5 to 75 Mc, 75 to 100 Mc, 155 Mc and 155 to 225 Mc. All ges are continuously variable and calibration is accurate to within The carrier deviation is continu- ariable from 300 Kc to 15 Mc.

instrument includes a marker gen- the output of which is mixed frequency-modulated carrier and in a pip on the trace. This al- e screen of the CRO to be cali- accurately in terms of frequency. arker generator covers from 10 to 22 Mc on fundamental but the range to 220 Mc is covered by harmonic output.

The marker generator, in turn, is checked by an inbuilt crystal oscillator on a fundamental frequency of 2 Mc and as the tolerance of the crystal is only 0.01 pc the overall error is likely to be small.

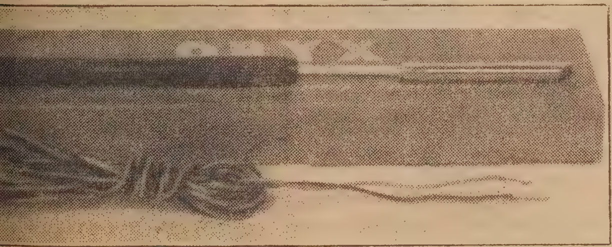
Provision is made for the inclusion of a second crystal if desired and for checking Australian receivers with the 5.5 Mc intercarrier sound system, a 5.5 Mc crystal would be very valuable. A magic eye is included for checks between the crystal and marker oscillators and a correction control for the latter is provided in order that the output can be made to correspond exactly with dial calibrations.

Two systems of controlling the frequency deviation of the 1323A are available and their use will depend on the oscilloscope available. If the oscilloscope has a horizontal amplifier, the input terminal can be connected to the mains frequency sweep terminal. The alternative is to take the output from the CRO time base (between 100 and 300 volts is suitable) and feed it into the terminal provided.

The overall size is 15 5-8in x 9in x 8¼in, excluding handles and feet.

The instrument reviewed was supplied by Jacoby Mitchell and Co. Pty. Ltd., 477-481 Kent St., Sydney.

ryx Miniature Soldering Instrument



AMPLE of the Oryx low-voltage dering iron is to hand from Manu- rs Special Products Pty. Ltd., 47 St., Sydney.

lar in size to an ordinary lead it will prove valuable for making ndreds of solder joints around re components in modern elec- equipment.

6-volt, 12-watt model tested melted solder one minute from the instant of switching on and was ready for soldering a few seconds later. As the iron takes only two amps, it could be operated from a transformer filament winding or a small accumulator.

The 12-watt model tested is available for operation on 6, 12 and 24 volts and for finer work 8.3 and 6-watt models are available.

The retail price is £2/15/-.

QUALITY SOUND BOOKLET

FOLLOWING the success of their 5-valve, 10-watt high-quality amplifier booklet, Mullard Australia Pty. Ltd. are now making available a new booklet, High Quality Sound Reproduction. Originally published by the English associated company, the booklet gives full constructional details of a 20-watt amplifier, an FM tuner and two pre-amplifier units, in addition to the 5-valve 10-watt amplifier.

As well as the theoretical circuit and list of components, a 3-dimensional point-to-point wiring diagram is given for each project. This will be of particular value to constructors with little experience in radio wiring techniques.

The local company have added an insert with information on local valve types and giving details of two loudspeaker enclosures suitable for speakers available in Australia.

The booklet is available from wholesalers or direct from Mullard, the retail price being 5/9 or 6/3 posted.

IT CANNOT LAST

Owing to increasing production costs it is regretted that the price of the K-2 tape deck kit-sets will have to be increased. This increase will not take effect until present stocks and materials are cleared.

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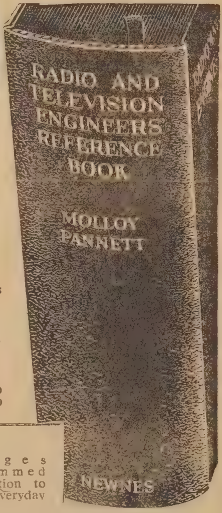
★ ★ ★

It is impossible to list above more than a very small fraction of the contents of this important new work—so we provide you with the opportunity to examine it freely in your own home and without obligation. Seize this opportunity by posting the coupon now.



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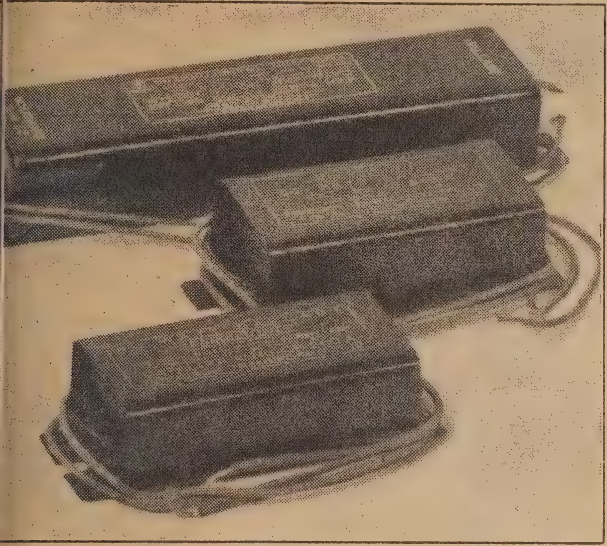

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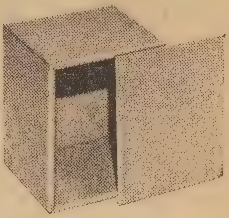

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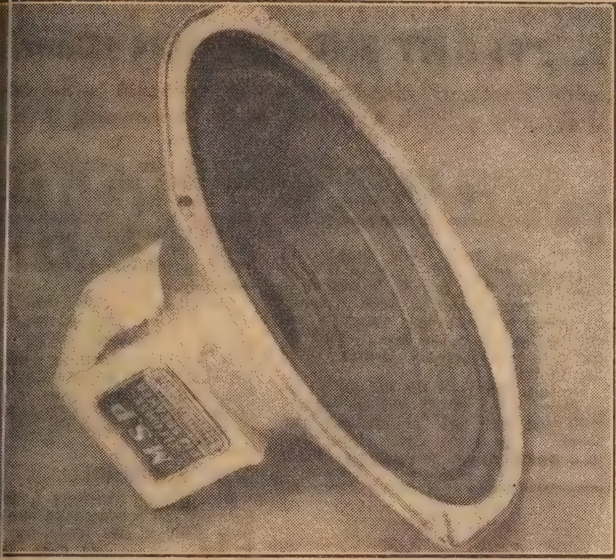

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PART ELEVEN . . ."FRONT END" DESIGN (Cont.)

Continuing last month's discussion of "front-end" circuits, we come this month to the mix
oscillator stage and the type of circuitry which is commonly found in television receiv

by Neville Williams

MANY of the general observations made last month about RF stages apply with equal force to the mixer — and for a fairly obvious reason.

Since the grid circuit of the mixer must also operate at the signal frequency, precisely the same problems arise in tuning over the required range, maintaining an acceptable L/C ratio and, finally, a sufficiently high dynamic impedance to allow the development of an adequate signal voltage.

In actual practice, the same tuning system is normally employed for both sets of signal frequency circuits, if only to facilitate tracking between them.

It is equally important to use short leads in the mixer input circuit, to keep stray capacitance to a minimum, to achieve rigid construction and to use a mixer valve with suitable VHF characteristics.

All these comments apply, in turn, to the local oscillator — perhaps with even greater force.

Receiver practice in this country dictates that the local oscillator shall operate at a higher frequency than the incoming signal, the difference between them being equal to the standardised intermediate frequency.

OSCILLATOR RANGE

Assuming that a receiver is designed to tune channels 1-10, the local oscillator must work between the limits 86.25 and 246.25Mc to give the requisite sound and picture IF signals.

Thus, although the tuning range is reduced from about 4:1 to less than 3:1, the absolute frequencies involved are higher and there is therefore that much less tolerance to stray capacitive and inductive effects.

Furthermore, the stability of receiver tuning depends directly on the stability of the local oscillator. Precise assembly and wiring methods are essential, as well as a careful study of all factors which might cause a shift in frequency with voltage, temperature or component ageing.

Quite apart from slow changes in frequency, which will be evident as a tuning drift, it is equally important to prevent rapid variations, such as might be caused by mechanical vibration. In extreme cases these can lead to flutter in the picture and acoustic feedback from the speaker.

In part, this calls for the use of an oscillator valve which will be substantially free from such "microphonic" tendencies. One valve maker claims that, in a typical circuit operating at 200Mc, a variation of only one-thousandth part of a picofarad in the grid-plate capacitance is sufficient to cause a frequency shift of 15Kc.

At the same time, stability in valve capacitance cannot be achieved at the expense of its other characteristics.

Electrically, the oscillator must operate reliably for all channels when fed through a dropping resistor large enough to protect it, should any circumstances cause oscillation to cease.

It needs to develop a sufficient RF voltage across the "tank" circuit to allow adequate input to the mixer with relatively loose coupling. This is desirable

to isolate the oscillator from
effects which might vary its fre
It is of little wonder, therefo
designers try to concentrate—an
—all these problems inside a co
tuning unit, which will be affe
little as possible by the circuits co
externally to it.

Before proceeding further, it
wise to make some explanatio
RF/Mixer coupling circuits.

In dual-wave receivers norma
tice is to use an RF coil having
tuned primary, carrying the plate
of the RF amplifier, coupled to
secondary which feeds the grid ci
the mixer.

DOUBLE CIRCUIT

In television receivers a com
coupling coil is often used also, b
both primary and secondary re
by means of variable slugs. (Se
64a.) Channel switching in such
would normally be effected by m
a turret, which would substitute
ent set of coils for each selector p

A particular advantage of this a
ment is that each winding has to r
with the "C" of only one circuit
plate or grid as the case may be
a larger amount of inductance
sible.

A further point is that the c
between two such resonant coils
adjusted, along with their "Q" fa
give a bandpass effect, with bette
tion of signals falling outside t
scribed channel.

In the simpler arrangement o
64b, only a single winding is used
must resonate with the stray capa
pertaining to both stages.

In this circuit the inductor p
a DC path for the plate current, t
return being through a resistor. T
ter can be made small or large, ac

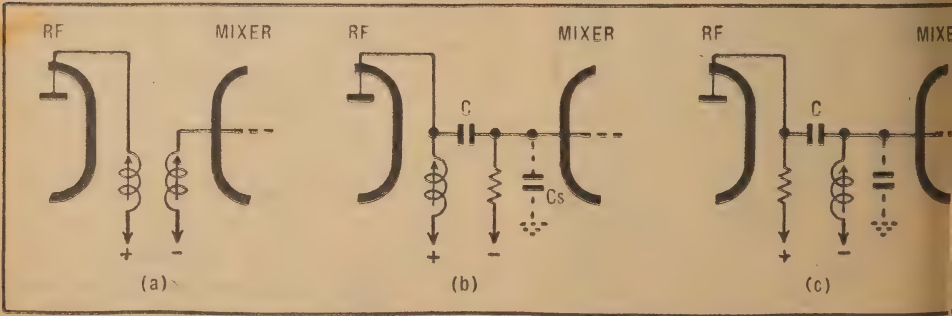


Figure 64: Illustrating various methods of coupling between RF stage and mixer: (a) double-tuned bandpass (b) tuned plat
(c) tuned grid.

amount of additional damping re-
across the tuned circuit to give
uired bandwidth.

noteworthy also, that the propor-
f the coupling capacitor "C" to
nt capacitance "Cs" allows a vol-
vider effect which can virtually tap
lowing grid part way down the in-
—should this be desirable.

re 64c shows the alternative ar-
nent, where the tuned inductor pro-
ne grid return path, the plate being
fed through a resistor. In both
ter cases, 64b and 64c, channel
ng would involve the substitution
inductor only.

choice of circuit is likely to vary
ircumstances and scarcely needs
comment. Thus the use of one
or another in the following ex-
ory matter is purely incidental.

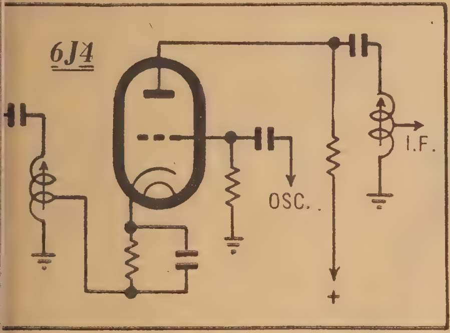


Figure 65, (left): A simple "grounded-grid" mixer. The signal is fed to the cathode while local oscillator voltage is injected into the grid return circuit.

y British receivers, operating about
Mc, often used quite conventional
onverter valves, with the usual in-
oupling between the mixer and os-
sections.

vever, such valves are structurally
ed to operation much above this
ncy, because of limited oscillator
, high inter-electrode capacitance
ng leads to the structure furthest
he base pins.

se factors are not significant at
frequencies but, above 50Mc, and
ng that the oscillator still operates,
adverse circuit loading, frequency
nd a high noise factor.

importance of noise in the conver-
dependent, to a large extent, on
in of the RF stage. If this latter
, then signal and noise content at
put circuits will be amplified to a
where a further moderate noise
ution from the frequency changer
no great moment.

CT OF LOW GAIN

the other hand, if the RF stage
s small, the signal passed on may
enough for the converter noise to
gnificant in the overall signal-to-
ratio.

well-designed receiver, efforts are
ably made to keep the gain up and
oise down in both stages, thus en-
the highest possible order of front-
erformance.

ny early television receivers, follow-ing accepted VHF practice, used entirely separate valves for the roles of mixer and oscillator.

By way of illustration, figures 65-67 show some of the arrangements which have found thier way into overseas commercial receivers.

Figure 65 shows a typical "grounded grid" mixer, which resembles the grounded-grid RF stage already discussed, except that the grid is returned to an oscillator injection source instead of directly to earth.

As with the RF stage, the input impedance is extremely low. This may necessitate tapping the interstage coupling circuit and, along with the loading effect on this circuit, results in only a small RF input signal being available. The effective stage gain (or more correctly, the effective conversion conductance) is therefore quite low.

While the noise content is also quite low, the limited "front-end" gain, which results, is a definite disadvantage.

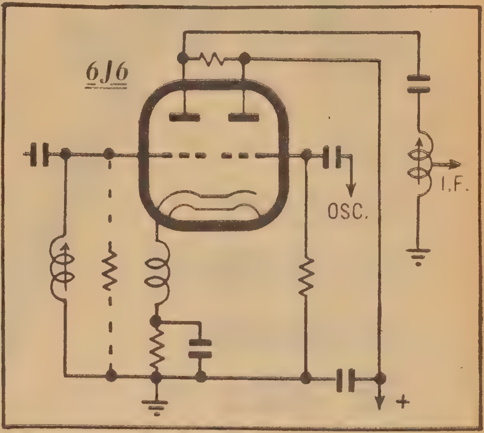


Figure 66 (right): A cathode-coupled mixer using a twin-triode. Gain is higher than with a grounded-grid stage but the circuitry is more complex.

Another early circuit, but one which avoids this difficulty, is shown in figure 66. Here a twin triode is used, one section serving as a mixer, the other for oscillator injection. Coupling between the two sections is provided by a common cathode circuit, although, inevitably, some coupling would occur through the mutual capacitive effects of the two triodes in a common envelope.

Since the incoming signal is fed to a grid circuit, the input resistance to the stage is much higher than with the "grounded grid" arrangement of figure 66.

A point of interest is that a triode can be used like this as a mixer in its normal "grounded cathode" configuration, without the chronic tendency to instability which would be evident in the same valve used as an RF amplifier. The reason is simply that, as a mixer, the grid and plate circuits are not tuned to the same frequency.

At the same time, some care is generally necessary to guard against instability when the tuner is set to the lowest frequency channel, where the signal frequency circuits do approach (though remotely) the upper limit of the IF channel pass band.

Figure 66 shows yet another typical mixer, using a high-gain VHF pentode, with oscillator input coupled loosely to

☆

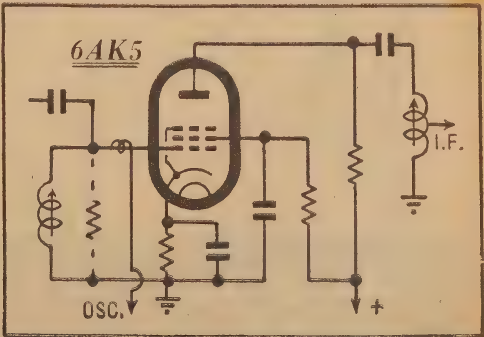
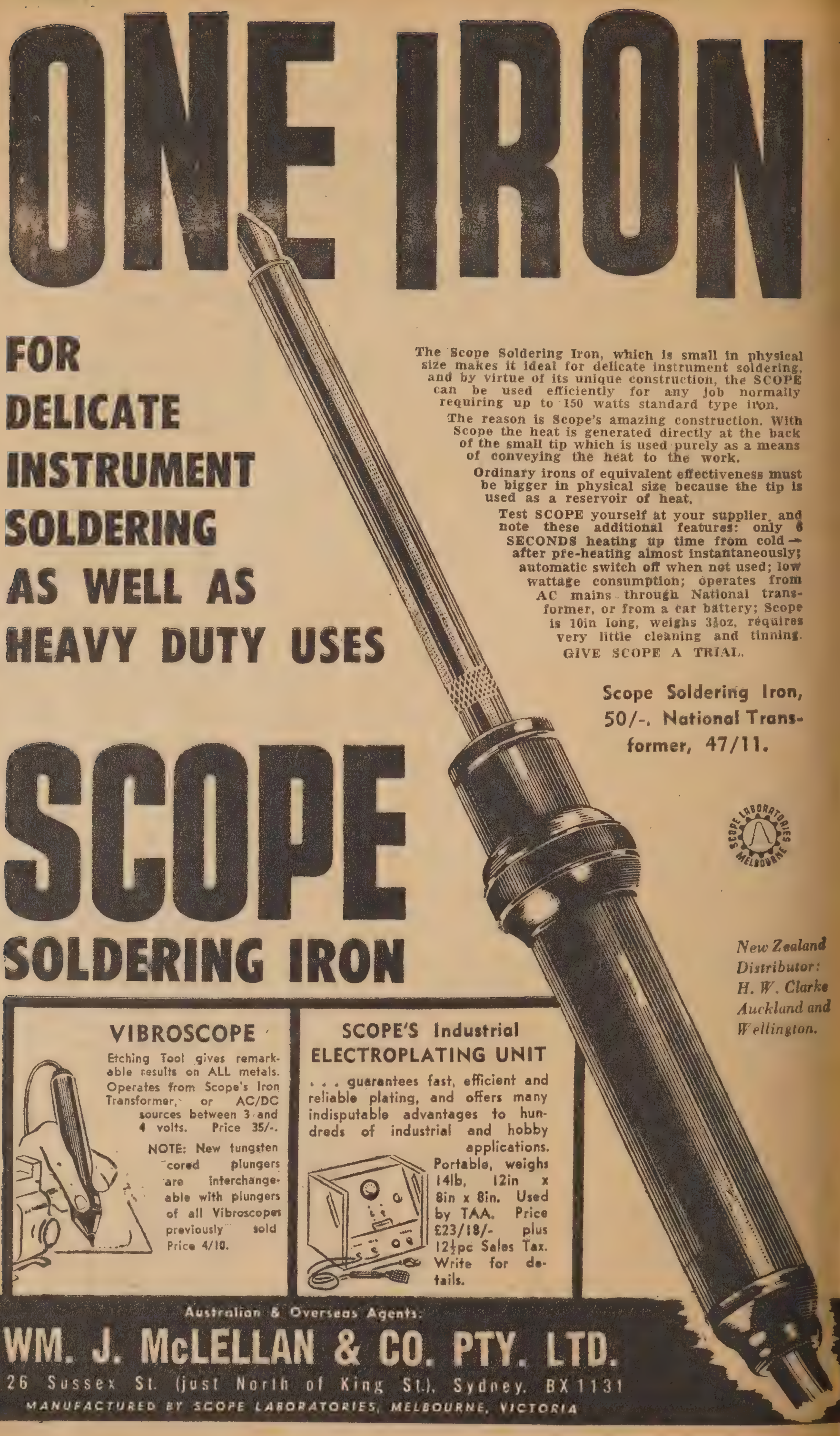


Figure 67: A pentode mixer with grid injection, as used in many early TV receivers. Modern receivers often use pentode mixer valves but with a separate inbuilt triode as the oscillator.



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MANUFACTURED BY SCOPE LABORATORIES, MELBOURNE, VICTORIA ıal grid. (This arrangement is very · in amateur band VHF receivers. ming a proper choice of valve /out, loading of the input circuit pentode is not severe, allowing ceding RF stage to develop across ıstantial signal voltage. This, com- vith the natural gain of a pentode. high conversion conductance.

ıis and the foregoing circuits, the or would normally be an entirely e valve.

ever, the need to economise in set has led, more recently, to the use multiple valve in the frequency ıg stage, instead of two separate

ι triodes designed for VHF ser- e now commonly used, one triode as a mixer, the other as an os- .

)E-PENTODES

ial triode-pentodes have also been ɔed for the purpose, making pos- a pentode instead of a triode The special advantage claimed for ode is that, due to reduced grid- :apacitance, its inherent stability er when the receiver is tuned to- he lowest frequency channel.

ıre saying more about these more ı circuit arrangements, it may be ɔ digress and to interpolate a dis- ı of VHF oscillator circuits, which appear unusual to readers only ac- ıed to ordinary broadcast band and vave practice.

the broadcast band, it is usually ary to arrange matters so that the plates of the tuning capacitor are h potential and this restricts some- he choice of oscillator circuit.

ractice only two systems are wide- d, the conventional plate feedback ements using a double wound coil ıe cathode tapped system.

vision set designers, on the other are not bound to use ganged capa- tuning. It is not necessary in a channel receiver and it is generally sfactory in one designed to cover a licity of channels.

a result, the designer is liable to he oscillator circuit as he pleases in :erests of convenience and stability. ck through past television set de- reveals an endless array of circuit ırations both single-ended and ɔull.

vould be quite a hopeless task in columns to list all such possible gements, together with the circuit ications which can occur in the way ra components, switching provisions ıe like. Many such arrangements ıave to be studied as they are ıtered.

LLATOR CIRCUITS

ıres 68 and 69 are conventional tor circuits using, respectively, feedback and a cathode tap on the oil.

h circuits, with their variants, ap- requently in broadcast receivers and se VHF receivers where the provi- f an extra winding in the one case, tapping in the other, is no special ːm.

ɔugh shown as triodes in both cases, le valves could be used, parti- y in the cathode-tapped arrangement, where the screen can serve as the virtual anode, and the plate for output coupling.

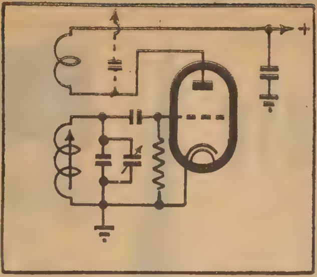

Figure 68: A conventional triode oscillator using a plate feedback winding often referred to as a "tickler" coil. The multiple windings complicate switching.

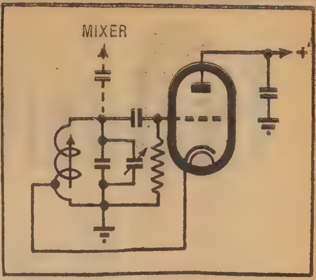

Figure 69: A conventional cathode-tapped oscillator. The need for three connections to the coil also complicates the problem of channel switching.

In a multi-channel television receiver, the conventional circuits of figures 68 and 69 are not very suitable. Additional windings or tappings only complicate the job of channel switching, and make it that much more difficult to isolate the inductor, on which depends the whole stability of the receiver.

There is a very distinct preference nowadays for "two-terminal" oscillators—those which require only two connections to the oscillator coil. A popular circuit is the "ultraudion", one which dates back to the very early days of regenerative broadcast receivers.

Actually, the ultraudion circuit is an adaptation of the better-known Colpitts oscillator and the similarity between them is illustrated by figure 70.

Figure 70a shows the conventional Colpitts oscillator, in which the tuned circuit is virtually tapped by having the rotors of the two-gang tuning capacitor earthed.

The effect is much the same as if the coil were actually tapped and made "earthy" at somewhere near its centre point.

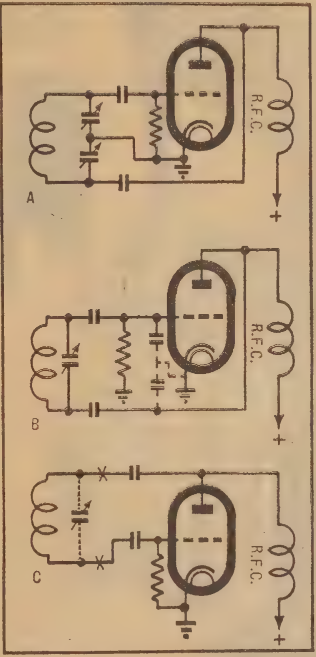

Figure 70: "Two-terminal" oscillator circuits. (A) shows the conventional Colpitts oscillator and (B) the way in which valve capacitances still virtually tap the tuned circuit. (C) is the same as (B) except that valve capacitances are not shown.

VIRTUAL TAPPING

In 70b the two-section condenser has been replaced by a single section unit and, at first glance, the tuned circuit would appear no longer to be earthed.

In point of fact, however, the valve and circuit capacitances from grid-cathode and plate-cathode maintain a virtual tapping point.

These incidental capacitances do not appear in a circuit drawing and it is normally shown as figure 70c, the ultraudion oscillator. The circuit lends itself to UHF channel switching, since

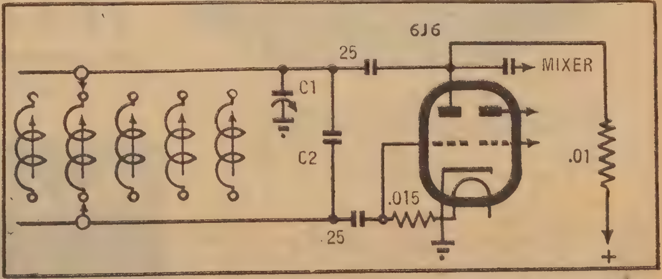

Figure 71: A complete and typical television oscillator circuit, arranged for channel switching. Inductance is normally adjusted for resonance, while C2 gives fine tuning.

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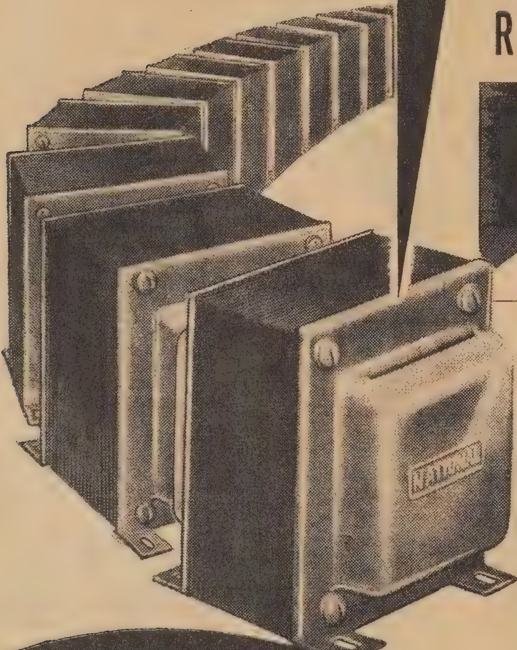

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A NATIONAL PRODUCT FOR A NATION'S NEEDS

e tuned circuits can be introduced
between the two points marked

capacitor has been shown dotted
tely, because its magnitude and
in the circuit may vary with cir-
ices. It could be connected on
ve side of the switch, so as to
ircuit for all inductors. Again,
al small capacitors could be
parallel with the low frequency
rs only.

capacitors may also be fixed, or
ed and part variable, while the
ice value may also be made vari-
means of a slug.

AL CIRCUIT

e 71 shows a typical form which
lete oscillator circuit may take.
capacitive component is made up
"strays" across the valve and
together with an additional small
r C2 which may be a selected
ture compensating type.

variable capacitor C1, connected
e side of the circuit to ground, can
ery conveniently as a trimmer for
ning" within each channel.

job of "coarse tuning" or channel
n, is performed by a turret or
arrangement, which selects the ap-
te coil, each one pre-tuned by
of its variable slug.

shall be looking more closely at
circuit arrangements in the next
when we discuss typical television

e meantime, it can be stated in
erms that most modern television
rs combine the function of mixer
cillator in one special composite
either a double triode or a triode-

iode serves in each case as local
or, the remaining unit as a mixer.
g between the circuits is largely
to the valve, being either capaci-
inductive, according to the choice
set designer.

ut from the mixer portion feeds
IF channel but here again, special
stances arise. The output of the
actually contains two resultants, as
e already seen, one representing
ion IF and the other the sound IF.
rding to the design of the receiver,
nay pass together through a com-
channel or they may be separated
o channels, each with a different
nd. This question must wait till
later, however, when we discuss
nnels and the intercarrier system.

TV INSTRUMENTS

(Continued from page 74.)

ff, a vertical line proportional to
voltage will appear on the screen.
the horizontal gain control is
up the additional information re-
g the waveform is displayed. The
ontrols can be used to manoeuvre
tern inot a position where voltages
n various parts of the wave can
asured on the scale.

continuously variable gain control
icates the reading of the voltage
and when the CRO is to be used
easuring amplitudes there is much
said for switched ranges after the
f the usual service multimeter.

ractical difference is that the re-
n of the oscilloscope trace is likely
less than that of a meter scale,
g it desirable to have the ranges
closely spaced.

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All features you would expect in a high priced Recorder but . . . of very moderate cost.

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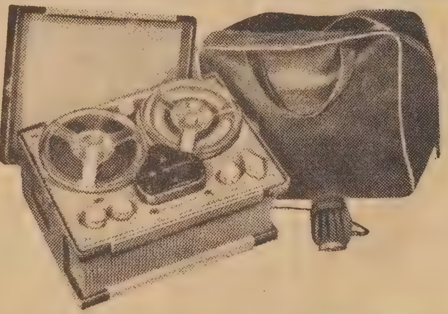

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HI-FI ALL THE RAGE IN LONDON

London has been ringing with the sounds of hi-fi demonstrations in recent months on a full-dres scale. There have been two exhibitions during which manufacturers have shown and demon strated their hi-fi equipment, and two sound concerts in the Festival Hall, one of them b EMI to show what can be done with their new Stereosonic sound.

by John Moyle

As I have commented elsewhere, the popularity of hi-fi equipment, particularly in London, is very great. This is only to be expected in a city whose outer boundaries hold together about 14 million people and which, for many months in the year, endures a climate most conducive to entertainment in the home, away from the cold winds and weather.

It is aided, too, by the great amount of concert and music-making which has made London one of the greatest musical centres in Europe. Without attempting to estimate whether the proportion of serious music-lovers is greater than elsewhere, sheer numbers guarantee that the market will be a useful one, irrespective of such a figure.

Consequently comparatively small companies specialising in amplifiers, speakers and pick-ups find a ready absorption of their products.

Record shops abound, often beautifully fitted-up to show off their wares. Added to them are radio and electrical shops, and even combination establishments selling cameras and whatnot, each with its own trade in amplifiers and tuners aimed at producing good sound.

LOWER PRICES

Their prices are much lower than equivalents in Australia, but even the higher-priced units are in great demand. Several well-established journals make a good living out of the hi-fi army, and you can buy a handful of very good handbooks covering every aspect of the subject.

In mid-April the Audio Fair was held at the Washington Hotel in Mayfair, and last weekend the British Sound Recording Society invited the trade to join with it at the Waldorf Hotel in Aldwych in a similar display.

The technique is to fill one of the larger halls in the hotels with stands upon which the various commercial apparatus is on show, while on the upper floors, hotel rooms, cleared of furniture, serve as demonstration booths in which continuous hi-fi sessions take place.

At the Audio Fair, most of these rooms were quite small and far from ideal for demonstrations. Nevertheless, a quite enormous crowd of people thronged the place during the days upon which it was open. On the last day, a Sunday, and despite the rain which fell steadily, there was during the afternoon a queue almost around the block of people waiting to get in. The intake had to be controlled to avoid a hopeless jam on the stairs and in the narrow passageways.

This was the first time this event had been held, and I think all concerned were completely taken aback by the interest it aroused.

It would be rather pointless to make a list of all the exhibitors, because they included practically every firm connected with sound recording and reproduction. The amplifiers themselves followed a fairly conventional pattern.

Nor were there any great surprises in pick-up design. The ceramic cartridge does not appear to have progressed past the popular Acos turn-over type, and the moving iron and moving coil movements seem to be most favored for highest qualify.

The variable reluctance type, which I have classed as a moving iron, is very popular, with one or two little refinements added by people such as Tannoy, whose big co-axial speakers were most impressive in the single-unit field.

Two loud-speakers impressed me for their introduction of new principles. One, produced by Plessey for the middle and upper range, is known as the Ionophone.

It has a small unit, fitted to a horn, in which the air is ionized by an oscillator operating at 30 Mc. The oscillator is modulated by the signal, so that the air is made to vibrate without the use of diaphragms or mechanical devices. Unfortunately, the model shown required an oscillator of several watts capacity and, at the frequency used, it could cause interference with other equipment. At the same time, the idea has many advantages; one would expect excellent transient response and linearity, at least in the upper registers.

But the speaker type which impressed me most, an impression carried over to the BSR exhibition, was the full-range electrostatic, on show by P. J. Walker, of Acoustical Manufacturing Co., and also by Goodmans.

In appearance, they are slightly curved, something like a fire-screen, and have a large, polarised diaphragm radiating all frequencies.

Although this type is still under development, the acoustical type was given a delivery price of £42—delivery date unspecified.

Apart from being extremely clean, a tribute to its low distortion, it has a quite individual presence of a type usually associated with multiple speakers, but with an almost three-dimensional effect all its own. This is probably tied up with the unique type of wave fro produces, and it certainly stopped n my tracks!

H. J. Leak also had a middle-high trostatic speaker in action, and I that every speaker manufacturer of is working with them in England. quite sure that in the near future type of speaker will hit the head and will probably become the first sign to challenge the moving co the high-quality field.

I do know from conversations most of the speaker manufacturers they are taking it very seriously inc although there are still some prob to be solved.

NOT PERFECT—YET

One of these may relate to p handling, and to mechanical rigidit general. The electrostatic also req a polarizing voltage, which Walker built into the base.

Don't panic and throw away latest acquisition. Don't even expect much for a while. But, if a few t nuts can be cracked, it looks mi good in the high-quality field.

Referring now to demonstrations, entertained a large audience in Festival Hall on April 26 with a der stration of their Stereosonic tapes.

They used two mighty speaker sys spaced wide apart at each side of stage, and very powerful amplifier drive them.

The tapes were essentially produc types which can be obtained her England for binaural work. The e recording technique is something veloped by EMI which employs sp dual microphones for the purpose.

The whole thing was expertly c pered and most impressively produc

The stage was laid out as for orchestral performance, but there no orchestra. There was also a p and a violin, but again no perform

EFFECTS

When a recording of the orchestra played, the lights came up on the m stands, and when a piano piece was grammed, an attendant came out opened the lid.

How did it sound? Mighty fine, demonstration of recorded music. It' mean feat to produce a recorded c estra about twice as large as life hall which seats nearly 3500 peopl takes a couple of hundred watts t that.

But I fear that only a few pe sitting in the right places really h stereophonic sound.

Sitting slightly to the left, I hea some of the time, but mostly there a decided hole in the middle w wasn't very impressive on either a p or a violin.

impression was highlighted by mpere's repeated invitation to re- it as indistinguishable from the ning. It sounded, as I have said nice indeed, but the deception at was only too obvious.

lism was not helped by the studio teristics of the recording being mposed on those of the hall. Only organ record, in which this supple- d reverberation was more in keep d the result sound convincing.

the most part the recordings d just what they were — good being played back on a loud ampli- lower level would have helped, larly on individual items such as llo. Surely never was an instru- devised which could produce such me as I heard from a single in- nt!

GS' DEMONSTRATIONS

A. Briggs, manufacturer of Wharf- peakers, has been giving recorded strations for many years in Eng- nd America, and for the good of me I sincerely hope he continues so. It's no mean feat to draw a of about 2500 people, most of paid for their seats, to listen to products.

re is something like stark courage ed when, as competitors with the ings, the actual players who made are brought along to complete the l selections which the amplifiers begun.

re is something infinitely intriguing tch Harry Blech and his Mozart s listening to the first half of a movement which they recorded s very hall, and waiting for their take up from the recording at an priate break.

l an even more deadly comparison tained when violinist Campoli, t Leon Goossens, and pianist Denis ws perform the same feat.

hought these demonstrations the of their kind I have ever heard. care had been taken to balance und so that the recordings and the mers played at the same volume. ng neon lamps on a specially made meter indicated how much power eing used at any moment, so that dience could draw their own con- ns on this score.

E AND VIOLIN

far as realism goes, the oboe and olin were the most successful. They so good that, although one couldn't he change-over, it might have been to tell the real from the record oth been played behind a screen.

difference was more marked the orchestra began to play. Here s more a matter of presence and distribution than anything else. lthough it was different, it was so so convincing a substitute, that I ne, could listen to either with al- equal pleasure.

er a few "gimmick" noises, and a arison with a few organ stops, the rmance closed with a recording of ir, orchestra and organ in the Hal- h chorus, supplemented by Ralph nes on the Festival Hall organ and Mozart players under Harry Blech. the flesh.

is produced some of the most ex- ting sound I have ever heard in fe. The Festival Hall is a mighty one to saturate with sound, but have I heard it groan at the seams did on this occasion.

Organ, orchestra and amplifiers combine from the stage of the Festival Hall in a demonstration arranged by G. A. Briggs.

I think we estimated afterward, by reference to the "watt-meters", that all told, we were getting the equivalent of about 350 watts.

Incidentally the equipment used included four three-speaker Wharfedale sets in sand-filled enclosures, specially reinforced, driven by four Quad amplifiers in parallel. Most, if not all recordings were on tape, some specially made for the occasion by EMI.

Mr. Briggs also played one or two of the stereophonic tapes made by EMI and similar to those heard in the EMI demonstration two weeks earlier.

My reaction to these was much the same as when I heard them on the first occasion.

Now the Briggs concert was just good fun, a fine illustration of what can be done with modern gear, and a get-together occasion for many devotees of hi-fi.

But EMI's was more than this. It was the forerunner of the inevitable day when stereophonic sound will be exploited as a major selling point for the record companies.

The LP record is now a stock item — there is no longer any novelty about it. The record people have seen the value of a new technique to their business, and they are, over here at least, watching each other very carefully for something new.

(Continued on Page 123)

Portion of the audience at the Briggs demonstration. The editor can be seen in this picture—though only just—second from the right and about fourth from the top, looking almost directly at the camera. These demonstrations have been highly successful.

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AN APOLOGY:—

"We have been requested by EMI (Aust.) Co. Ltd., to point out that "Scotch Boy" recording tape is not manufactured by their company and the clearance line of tape offered by us is "Emitape" not "Scotch Boy" as advertised by us in the "Sun-Herald" of May 20th, 1956."

OFF THE RECORD — NEWS & REVIEW

BY THE TECHNICAL EDITOR

Of special interest, this month, is the release of two "demonstration" records, by sepa companies, especially designed to give your amplifier a packaged workout.

IT could probably be argued that "demonstration" records are pointless, these days, in view of the fact that routine pressings are so good that so many of them contain sections of high technical merit.

While this is certainly the case, it is equally true that a demonstration disc is useful when one has to make a not-too-prolonged assessment of a particular amplifier set-up. The impressions of a single disc can be retained fairly well and there is the added assurance that something released for demonstration purposes should have been selected and processed with more than ordinary care.

The discs in question are not nearly as elaborate in their compilation as some of the pressings which have been released overseas as, for example, RCA's "Adventure In High Fidelity." But neither are they as expensive — which is always a consideration.

HI-FI Demonstration Record, Capitol H-007, 10-inch, 33rpm.

This Capitol record, one of the first on this label to be released through EMI, will probably find a use in radio showrooms, the listener being told what to look for in each successive hand-picked sample of Capitol's "full dimensional sound."

Perhaps I should put "told" in capital letters, because the voice is very forward, very American and very loud, when compared with the amplitude on the musical tracks. However, it is good voice recording and that may be justification enough on a demonstration disc. (Perhaps the levels have been arranged that way to discourage overzealous demonstrators from frightening fair customers with a deluge of musical sound!)

Speaking of music, there are six tracks of "popular classics" on one side and seven "pop" tracks on the other—presumably to keep everybody happy. Piano, brass, strings, full orchestra, voice, all take their turn, with a few other oddments for good measure.

If you're put in the position often, where you have to explain to callers what "high fidelity" means, this will be a good one to have collection. It will do the job f

As might be expected, the reco clean from the first note to t while the surface is also goo from a few minor clicks.

Demonstration Excerpts from Lake Ballet" (Tchaikovsky); Min Symphony Orchestra, Cond. Dorati. Mercury OLD3-AB.

Of a quite different kind fr Capitol disc, this one has two, o we say three, aims in view: (1) T as a demonstration record; (2) T cise Mercury's "single-micropho cording technique; and (3) to a their recording of the "Swa Ballet," done on three LP discs all accounts, the first and only a follow the complete and origina

Further comment about the c album would best be left to appropriate occasion.

The demonstration disc contai excerpts from each of the Fo eight excerpts in all, to be precis include, amongst others, " Scene," "Flight of the Swans," "D the Swans," "The Ball" and Scene."

This latter packs just about a modulation on to the grooves a seem possible, with brass tha blares. But it is clean, well defin to the end.

It's good demonstration which, by contrast, with the disc, contains no sales patter. T risk is that you'll be so frustrate cally by the fragments that you' duced to buy the complete thereby falling victim to intent (3) mentioned above.

If the Capitol disc is aimed novitiates, this one is just the assuming that the audience wi what it's all about. You'll prefer one or the other on tha as much as any.

"SOUNDS OF OUR TIMES"

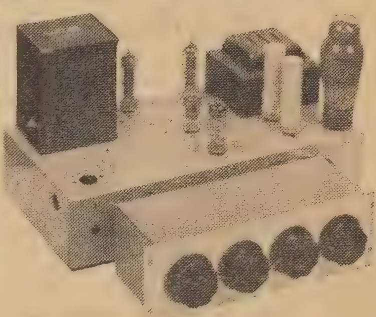
So much for the demonstration as such. However, while in t mood, high marks must be given Cook "Sounds Of Our Time which came to hand for review.

Cook Laboratories of Stamfor USA, make much of their policy turing sounds—all kinds of so their native surroundings. The records are broadly typical a reaction to them will vary shar your musical taste.

Pedal Harpsichord playe Bruce Prince-Joseph. Vivaldi Concerto No. 2 in A minor; M Sonata in C major; Bach, Gre lude in G Major; Bach, Bou (from English Suite II in A M Cook 1131, 10in, 33 r.p.m.

Prince-Joseph, an organist

MAXIMUM VALUE



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est European traditions for
rument.

-harpsichord is quite massive,
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id. It has two manuals, and
board with 16', 8' and 4'
ie manner of an organ. The
s are mounted in the base
d controlled, for volume, by
utters—again reminiscent of
ice.

s the commentary points out,
l of traditional organ music
sed with a view to its pos-
mance on a pedal harpsi-
ch had just such an instru-
own home.

e link between the two instru-
one of mechanics. When
h calls on the full potential
rument, as he does in the
ide, the musical relationship
two is quite obvious.

where, it is a harpsichord,
ystalline clarity, its terrific
s brief "dwell" — and, its
limitations. With such an in-
iere is no room for error on
the player. Every single note
ity.

gineers have caught the sound
strument superbly and the
ids well on any good equip-
u have any interest at all in
hord and the selections listed
'll enjoy this record.

you would want to play it
rough at one sitting is an-
. The harpsichord can be a
change, but it can also be-
isome.

ORGAN

pass on and step into another
ether, to an instrument which,
any other, catches the spirit
enties", the silver screen, the
ace and the gaudy gilt that
it.

Pipe Organ, played by
Cheshire. Volume I. Cook

onths ago, in the "Argument"
ve quoted from a review in
y Tatnall Canby; we chortled
ription, his undisguised, earthy
a particular recording of the
gan—every stop every effect,
ver, sheer unadulterated "or-

ouble was that I personally
e the record to hand to share
ns.

lon't have the particular one
ecording by Michael Cheshire
is probably in similar class.
gan in question is a colossal
in an equally colossal 5,000-
re in Richmond, U.S., which
to the peak of the silent pic-
-to 1926. The atmosphere in
ace is ready-made. The console
raulically into view; a single
otlight focuses on the sleek,
rganist.

e crashing chords of the mighty
first from here, then from
h one answered by an echo
remote corners of the theatre.
no ordinary performance, "pop"
day which are forgotten to-
This organist aspires to greater
he 2nd Hungarian Rhapsody,
larket, Zampa Overture, Coppelia Waltz, then, more simply, Londonderry Air and the Bells of St. Mary's.

Twenty minutes later, it's all over. The console sinks from view, the spotlight goes out and the organist does likewise, through a little trapdoor that leads away backstage. The mighty Wurlitzer lies silent and deserted till the next session!

If this means anything to you (nostalgically), if you have the common touch (musically) or you like to hear an organist walking up and down his bass pedals (as he does in the Hungarian Rhapsody), then you won't miss this record.

It is Dixon, Foort, Torch and others playing again through the hands of "Michael Cheshire," a name which, I shrewdly suspect, hides the identity of one of the aforementioned. But whereas organ recordings of the past decade suffered all the limitations of the then recording standards, this one is Hi-Fi, in the modern sense of the term.

Pipes, effects and echoes, singly and en masse, stand out with startling clarity.

I was going to add, "if you can take it," but the phrase is scarcely appropriate. It should rather be reserved for the third of the Cook trio:

"Clambake on Bourbon St." Tony Americo's Parisian Room Band. Cook 1085.

The only reasons why such a title can make these columns are (1) Hi-Fi interest and (2) absence of the editor.

But wait a moment. I recall that it was only two months back that the Editor reviewed "Blowout At Mardi Gras". I didn't hear the particular disc but it apparently isn't very far removed in spirit from "Clambake."

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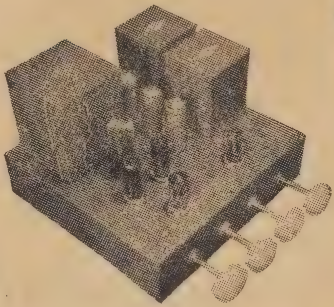

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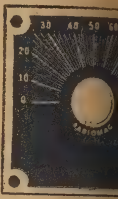

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you must excuse the writer ing too familiar with Tony Band, or its haunt at 116 et, New Orleans (one flight

do I fully understand the f playing a trumpet, as Sam loes, without plungers. Or is

now that it produces the most eudo-human wails, or tearing dden bleats according to the [illegible] grave' a tenor and a Dixie "jam' you have a pretty good summat this record contains.

ike that kind of thing, either r as a source of Hi-Fi signal, his record. If you don't, you'd s it right off your list. But I'll uch. If you want a "shocker" ow friends, you won't do much the "Waffle Man Blues," the er on side A.

LE AGAIN

m here we get back to more siness. Some months ago, the iewed a recording by Dorati Minneapolis Orchestra of the ade Symphonic Suite, opus 35. ng to the sales people, stocks e were not nearly adequate to emand. The position has now ied and they have asked us to review in question.

is:

KY - KORSAKOV. — Schee Symphonic Suite, Opus 35. by the Minneapolis Symphony ra, conducted by Antal Dorati. y MG50009.

d purely as a recording, this highest class.

y's single microphone technique distinctive brilliance, unmatchway by any other studio.

razade" is an ideal vehicle for only is it a show piece with s, but it provides a succession assages for almost every instru-

s the extremely forward reight not suit everything, it is an ng success here. Something in on of solid color may be lost in uch as the Young Prince and g Princess, which would have little more romantically from a istance.

other hand, there is an oppor- show off some fine string tone, wood-wind does not make the of trying to compete with it.

ynamic range of the disc, as hese Mercurys, is a vast thing, es such passages as the final ite tremendous in their force.

pportunity is lost to show up lity of the orchestra, which rough the ordeal without a falrati handles it with an almost control, and its flexibility and will delight you.

ide dynamic range means that music is playing well down into level, and I would have liked a smoother surface. The tennd indeed the advice—to "turn ick" means that the surface must xtra scrutiny, and wide range nt will show that it is not comuiet. Elsewhere, of course, the swamps it out.

requency range is wide, but the on to overdo the bass has been y withstood. At lower volumes of extra bass will be in order, ought the balance in every way irable.

I can't imagine a recording of Scheherazade with more brilliance and impact than this one.

Although A.E.S. curve is recommended, I dropped it down to E.M.I.

★ ★ ★

At this point we can well include a small review by the editor which, through lack of space, was pushed out of a couple of earlier issues:

★ ★ ★

SONGS OF SCOTLAND AND IRELAND—sung by Father Sydney MacEwan, with orchestra, conducted by Philip Green. Columbia 330S-1073.

No doubt this disc will be welcomed by many who have fallen under the spell of his beguiling voice in the past, but to me it was a disappointment.

The numbers have apparently been collected from various sources, but the best of Sydney MacEwan is not here.

His voice as we hear it is past its prime, and frequently shows signs of wear and strain. It has hardened so that often there is little left of the gold.

But I'd be a client for a record of his songs as we knew them 15 years ago, if technically they would stand the resurrection.

★ ★ ★

And now a couple of other discs which will be of special interest to particular reader-groups.

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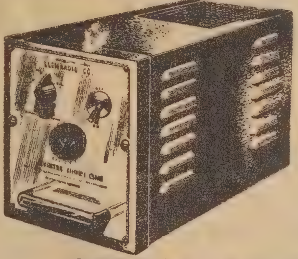

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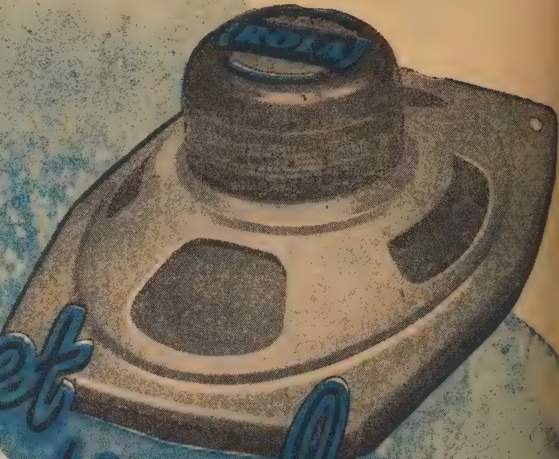

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ROLA COMPANY (AUST.) PTY. LT

THE BOULEVARD, RICHMOND, VIC. JB 3921. 116 CLARENCE STREET, SYDNEY, N.S.W. BX

ald Moore. Columbia 33-
3.

d to this record with a good oyment, partly because it hap- strike a sympathetic chord. I have always felt that ac- are like "prophets without " whether they appear on the tform or the stage of a local t.

their light, they have a task erous or responsible than the they are too often regarded stage prop, rating no more two lines in the Press pal Moore begins on this note, then o show that the accompanist person, playing real music, equently one half of an instru- al duet. Without proper in- n, the message of the song- arbled or only half-told. Each well illustrated on the key- he proceeds.

accompanist, Gerald Moore ntroduction. What is less well the fact that Moore has a umour which he can mate with nce and his facility at the key- produce highly instructive yet g platform lectures. That's is, only on a tightly-packed P. disc.

ck full of commonsense, freely by excellent snippets of piano and spiced with the stuff of ckles are made. The record tural" for music teachers or ving a special interest in accom- Its role in other collections rather more obscure, though it vide a congruous change from are.

of the anecdotes, which Moore n, are "evergreens" but he measurably over the usual by not having to rely on a m-de-dum to put them over.

E ART OF THE ORGAN"
1. E. Power Biggs. Com- ns by Bustehude, J. S. Bach, and Sweelinck played on fferent concert and cathedral . — Philips ABL 3066.

ecord has an interesting back- In 1954, the well-known Ameri- anist E. Power Biggs, made a tour of Europe, giving recitals of its famous organs, old and th him, for good measure, went g gear, which was to retain ma- a set of organ records.

hen it was over, how best could array of material be presented? y recital on just one or two in- s was not the object. A motley nt of excerpts on different in- s could be confusing. Repetition gle excerpt could easily be tedi-

solution to the problem, prob- good a one as any, has been to hort excerpts on a number of in- s, the excerpts differing, but re- certain instances to the locale od of the organ on which they ed.

for those who may want to instruments more closely, Biggs cond record, yet to be released in which the one selection is ver and over again—an experi- hich, according to overseas re- more successful than one might imagine.

ver, be that as it may, Volume organ lovers' fare. Nor will its be exhausted in one sitting

There is much to listen for: The enormous contrast between the 1929 Steinmeyer organ in Frondheim, Norway — with all its complexity, facility and brilliance—and the 1612 Esias Compenius at Hillerod, Denmark, which immediately follows it; or, yet again, the simple Johann Cahman (1725) from Drottningholm, Sweden, which is next on the list.

On each side, these old and not-so-old organs are sandwiched in between their modern counterparts, including the organ at the Royal Festival Hall, London. For each one, the specifications are given on the jacket.

But how much of the difference is due to these specifications, the building acoustics, or to the music and the stop combinations, which the organist has elected to use, can be the subject of much debate—if your interest lies in this direction. And that, I think, will be the deciding factor as to whether you will want this record or not.

Overseas, it was hailed as a "hi-fi" disc, and it is certainly excellent technically with good definition and no surface noise. In fact, the definition under other circumstances might be considered a little too good in places, for it reveals the mechanical noise of some of the instruments, along with their musical qualities.

At the end of side one, Bach's Toccata in D Minor, recorded on the inside track, will provide a brief but searching test for your pickup in the first instance, then for your speaker and its baffle. It's a lot of organ to cram on to one tiny, meandering track—but it's there!

PERCY GRAINGER ON CHORAL SINGERS

CHORAL singers may become obsolete in this mechanised age, according to Percy Grainger, famous Australian composer and concert pianist.

Grainger made this comment recently when he and his wife arrived in Vancouver on their way to San Francisco for a series of concerts.

"As machines get more like the human voice there is no reason why choruses can't be produced mechanically," he said.

He claims a mechanically played composition would have "more soul" than one played by human performers.

He has been working on machines in the hope of perfecting one that can produce sounds exactly as a composer "hears them" in his imagination.

He said there was always conflict between a composer's idea and a performer's interpretation.

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SHORT-WAVE NOTES BY ART CUSHE

WINDWARD IS.---LATEST VERIFICATION

The verification of the Windward Island station, using the very low power of 250 watts, makes our 149th country verified. Stations in Lybia, Mozambique, Dutch New Guinea and the Dominican Republic were included in the mail.

WINDWARD ISLAND Broadcasting Service at Grenada confirms reception on a green card, signed by R. A. Smith, Engineer in Charge. The transmitter on 17745 Kc, opening at 7.55 am, uses only 250 watts and a half-wave dipole antenna.

The station is on this frequency 8 am-12.15 pm daily except Sunday. Other transmissions are carried on 3395 Kc, using a power of 5000 watts to a vertical antenna, using the same schedule.

DUTCH NEW GUINEA

Radio Soring, Sorong, operated by the MV Nederlandsche Nieuw Guinee Petroleum Maatschappij, Soring, and broadcasts on 3395 Kc with the power of 500 watts. In verifying by letter the General Representative informs us that the station is now operating as follows—Daily, except Wednesday and Saturday, 7.30 to 10 pm, and Sundays, 11-1.30 pm.

DOMINICAN REPUBLIC

The new 85-metre transmitter of "La Voz Dominicana" confirms reception on a flag card, as a backdrop to a map of the Republic. The new transmitter has the callsign HI7T on 3285 Kc and uses 1000 watts. The complete network is: HI2T (9735) 7500w, HI3T (620) 10,000w, HI4T (5970) 7500w, HI5T (F.M. 100 mcs) 250w, HI7T (3285) 1000w.

The address is given as "La Vox de Dominicana" Palace of Radio and Television, Trujillo City, Dominican Republic. The station opens on all frequencies at 9 pm.

MOZAMBIQUF

Verification from the Radio Club of Mozambique, The Station of Happy Listening, PO Box 594, Lourenco Margues, came in the form of a card with a map of Africa and waves radiating from the transmitter site. CR7BG, operating on 15080 Kc with 10,000 watts, is the station we verified, and which we heard in April. The station is still being well received from 3 to 4 pm with a program in Portuguese.

The station formerly operated on 15281 Kc, but the new frequency has resulted in much wider reception, including the signals in the transmission to sign off at 6.15 am. This broadcast is well received in Europe.

HILVERSUM USES 15365 Kc.

The use of a new 19-metre frequency with excellent results in this area is being used by Radio Nederlands, Hilversum, in the North American and South Pacific transmission, in the afternoons.

The normal late evening transmission to the South Pacific, as is usual in the winter, is poorly received, and the new coverage in the afternoon provides good signals for both Dutch and English listeners. Transmissions on 15365 Kc are:—12.30-1.10 pm: To North America, New Zealand (English) 15365, 9590 Kc. 1.15-1.35 pm: Spanish to Central America, 15365, 9590 Kc. 12.30-3 pm, Mondays: Happy Station Program. 15365, 9590 Kc.

VUNC ON 9560 Kc.

Signals from the Voice of United Nations Command, on 9560 Kc, are being well received from sign-on at 9 pm. Signals are heard at 8.55 pm, when a tone was noted, then at 9 pm, the anonuncement in English, "This is the Voice of United Nations Command" was heard.

A short orchestral march followed and this in turn by an announcement and program in Korean. Signals were severely jammed from this time onward and exact nature of the program was difficult to identify. VUNC, which is reached by a report to the Headquarters, US Armed Forces, Psychological Warfare Section, Tokio, operates VUNC in Seoul on 560 Kc, Pusan 4780 Kc, and uses NHK transmitters JKK (6015) and JBD2 (9560), JBD (9505).

The Tokio stations operate as follows: JKK (6015) 11.30 pm-7 am, JBD (9505) 9 pm-2 am, and JBD2 (9560) 9 pm-4 am. A network of NHK b.c. stations also carry the VUNC broadcasts from 12.35 to 1.05 am. They are on 690, 830, 870, 1030, 1050, 1330, while a further transmission 1.05-2.35 am is carried on 690 and 830 Kc.

Notes for next issue should be sent to Arthur Cushen, 212 Earn Street, Invercargill NZ. All times are Eastern Australian.

IVORY COAST'S Radio Abidjan, has been heard opening at 4.45 pm with light music to 5.00 pm has news in French at 5.00 pm, when a news session is presented, and the station is heard closing at 5.32 pm. Len Collett, Oamaru, NZ first to report this station to us, states a bad heterodyne and Morse is troublesome. The latest information from Ivory Coast reports this station on 4945 Kc as now using 10,000 watts, and that is the reason why this station is being so widely received, and this adds another African country to which signals are now possible to be logged. African signals should be heard during this month both at dawn and in the evenings at dusk on these 60 metre frequencies.

RADIO STATIONS IN BANGKOK

The following stations operating in the Thai capital, are supplied to us by Percy Hurley, RNZN, who has recently been in that city during a Far East tour of duty.

Owners	Frequency	Schedule
Public Relations Dept.	11670	2.15-3.15 p.m., 7.30-midnight
Public Relations Dept.	6001	7.30-10.00 p.m.
Post and Telegraphs.	4755	Mon. to Sat. 7.00 p.m.-12.30 a.m.
	5955	Sunday 11.00 a.m.-12.30 a.m.
Post and Telegraphs.	7035	Mon. to Sat. 5.00-7.00 p.m. 11.30 p.m.-1.00 a.m.
Army Dept.	5978	9.00 a.m.-1.00 a.m.
Public Relations Dept.	5790	2.00-5.30 p.m. 6.00-10.00 p.m.
Navy Dept.	4340	Mon. to Sat. 2.00-5.00 p.m.
	6090	10.00-1.00 a.m.
	6100	Sun. noon-3.30 10 p.m.-1.00 a.m.
Air Force.	6540	Mon. to Fri. 9.30-10.30 a.m. 3.00-4.00 10.00-12.30 a.m.

FLASHES FROM EVERYWHERE

LATIN AMERICAN signals have aga providing good reception during the la noons and the lower frequencies ha heard with exceptional signals. The section has been found with consisten from Radio Continental, Arequipa, 3290 Kc to sign off at 4 pm.

This is a new frequency and transm the Arequipa station, which anonunces as (1370), OAX6E (6055), and the new OAX6D. The station generally relay music and uses Somewhere Over The as the signature tune.

A new Colombian heard to sign off is a relay of Radio Nacional Bogota. tion gives the network of 680, 5010, 4 and 11680 Kc when closing, calls of HJCQ, HJCT, are announced.

Radio el Sol del Peru, Lima, usi signs off at 3 pm (but at times later strong signal. This station announces (900), OBX4Q (5970), and OBX4C (15

Typical Latin American dance porg broadcast, with frequent commercial ments. Signals on both 50 and 19 m good, the 19-metre signal being at peak

The use by Venezuelian stations of f in the 120-metre band, in the vicinity Kc, will somewhat prevent reception area, but at times signals may be n 8 pm when the main stations in tha sign on.

CYPRUS station Sharq el Adna, has moved to 11720 from 6135 Kc an received with Arabic commercial pro 3 pm. At 1 am and later the station loggable, and they are also using 6 6790, 9650, and 11720 Kc.

ISRAEL'S new Galei ZAHAL stati new outlet on 6175 Kc, reports Wo Handbook, this channel replacing 672

TAO5, the station of the Technica sity of Instanbul, operates on 7143 100 watts and which was heard in land by the writer three years ago, broadcasting around 6 am. The Instan nical School, which also has a shor perimental broadcast, is now using 7

BRAZIL'S new Radio Globe, Ave Branco 183, Rio de Janeiro, has c daily transmissions on its new shortwa caster, using 6035 Kc. Operates fr onward. The Kc output PRE3 on with 50 Kw operates 7 pm-1 pm, so sumed the shortwave transmitter wou the same schedule.

COLOGNE'S Deutche Welle has ch 17815 Kc frequency to 17875 Kc fo East from 8 pm. The 15275 Kc c been moved to 15375 Kc to Latin and 9735 has been changed to 96 North America. This transmission well received on 11795 and 5980 t at 2.30 pm.

SWITZERLAND'S DX session bro the first Thursday of each month is leased as follows—5.15-5.30 am, 96 noon-12.15 pm and 2.45-3 pm on 6 11865; 5.45-6 pm and 7.30-7.45 pm 17784, 21520; 11.15-11.30 pm, 153 21520; 1.15-1.30 am, 11865, 21520, 2 frequency; 3.15-3.30 am, 11865, 15315

RADIO NEW ZEALAND has com test transmission for NZ Forces in M is carried on 9540 Kc. The broadcast air daily from 9.00 to 10.30 pm, and ZL2 (9540), after a short period on

VOICE OF AMERICA'S special p the shortwave listener and radio a again being presented at a convenien listening in this area. The broadcas ceived is on Tangier, 9500 Kc, on 7.45 am, and it includes news about reception conditions, sunspot and othe predictions, and news about new coun heard, with a special word for the amateur. Bill Leonard, who conduct sion, is an amateur in his spare time ducts the session with a practical vie

TAHITI IN ENGLI

AFTER a few days of a test br English, Radio Tahiti, at Pap continued with a program in English to 6 pm daily, on 6135 Kc. Signa cellent in this area, and reports fr Hughes, in Adelaide, also reports in South Australia.

The French Legation in Wellingto first to advise of this forthcoming br the success of this session as to licity seems assured. Most of the pr tent is of news and tourist features interspersed with a musical interl station leaves the air at 6 pm, afte lish session

HAM BANDS WITH BILL MOORE

and 50 to 56 Mc/s communication has been established for the first time between ian and Japanese amateur stations. These stations for the next few years will be for propagation conditions that will permit international contacts on the VHF bands.

's band was again wide open to m various parts of Eastern Aus- y May, approximately 28 days ous working.

asion the opening did not extend Sydney, but Jack Hill, VK2ADT, ard quite a number of JA's. It land that they really peaked and 4LK, at Charters Towers, seemed centre of the arriving signals.

1 to 9 Vern heard hundreds of a long wire, 430ft, no beams quired. Quite a number of other the Japanese stations. The best ption seemed to be in the even- 8.

of JA's expressed their willing- ate in 50-56 Mc cross-band work- in problem being how often the to 56 Mc/s, secondly the neces- beams and two converters for ing would complicate operation results to date the north-south Japan and Australia seems to be working and cross-band operation le.

the above, cross-band 50 to 56 between JA's and VK4LK have meritorious performance and a r amateur radio history in Aus- May the 50 Mc band was wide on many evenings and signals far south as Albury by Don 2RS.

recorded hearing signals from date the return path on 56 Mc/s open to VK4LK at Charters ubtedly during the next few years on the VHF's will be estab- peak conditions.

CONVENTION

convention of the Queensland f the WIA was held over the in June under ideal conditions nal Fitness Camp, near Palm e "Gold Coast" of Queensland. ovides all facilities, halls, tennis r a successful and enjoyable con-

attendance of VK4 and VK2 ussed institute organisation and the various field events.

local organisation was in the of Ramsay Bryce, VK4AB, Tex TX, Ossie Harris, VK4TN, and law, who acted as cook. Vice- nnie Pickles, VK4FP, and Vince secretary Jim Rafter, VK4PR, mbers of the council attended. events Noel Martin, VK4PQ, on other competitors in the in the 144 Mc search, previous ience assisted Johnnie Pickles. n this event.

ent Jim Corbin, VK2YC, acted for a number of sessions. The IA network in Queensland was ength, Vince Jeffs, VK4VJ, is co- his service. All the competitions ported. The only complaint was s and that concerned the cold

convention will be held at the nd already plans are being for- nsure that the YL's and XYL's ered for. Full publicity will be Palm Beach 1957 Convention.

OBSERVATIONS

BLE publicity has been given to of Professor Webster, of Queens- y, for the co-operation of radio he "Aurora Polaris" investigations ed during the International Geo-

r believes that amateurs can assist done in the US by observing s.

st will be centred on the 56-60 here reflections from auroral dis- occur and information gleaned considerable value.

enty of time before July 1, 1957, 56 Mc/s equipment in operation ns of the WIA would be pleased amateurs willing to co-operate.

SOME changes have been made in the presentation of standard frequencies transmitted from WWV, WWVH. They are as follows:—

The length of time the audio frequency tone is transmitted has been reduced from four to three minutes in each five-minute period, the fourth minute now only carrying second ticks.

The fifth minute carrying the voice announcements as usual. The above changes are effective at both WWV and WWVH.

WWV now has a silent period for four minutes each hour, beginning 45 minutes after the hour..

In transmitting ticks the 59th second tick is omitted to help in identifying the "zero" second. To further identify this "zero" second it is now sent double, the marker tick following at an interval of 0.1 of a second.

The accuracy of the transmissions has now been increased to 1 part in 100-million instead of 1 part in 50-million previously maintained.

BUILD OR BUY?

MANY overseas amateurs regret the general tendency, especially among newcomers to the hobby, to purchase commercial equipment for their stations. To date, due perhaps to greater cost, and sometimes to the lack of suitable gear, amateurs here still construct most of their equipment.

Such is definitely not the case in many countries, as from information obtained from contacts, over 90 per cent of the stations worked would be using commercial receivers.

Probably the greatest problem these days is to find sufficient spare time with so many other interests to embark on a large building program.

The construction of efficient receivers and, for that matter, a TVI proofed transmitter require much time, effort, and mechanical skill.

A number of amateurs now only take an academic interest in new developments and leave commercial firms to solve their technical and building problems.

There undoubtedly is a tendency to forget what goes on inside the elaborate boxes that house the station equipment, and only to worry about operating and that signal report.

Hand-operated CW transmissions have to a large degree been pushed into the background in recent years with the advent of radio-teletype, telephony links and other specialised means of communication, but as pointed out in a recent MARS-Naval (a US naval amateur radio organisation) bulletin, the days of the key-puncher in the radio field are by no means over:

"CW remains—with good reason—a vital means of communication. It can be copied through atmospherics, interference, and jamming at times when RATT and voice are unreadable.

"It is the primary means of delivery of ship-to-shore traffic. It fills a vital need for medium and long-distance early warning nets beyond the range of reliable voice communications. It is faster than voice for all but short tactical messages.

"In communication between allies of different nationalities it has a great advantage over voice radio because operators do not need to understand or interpret the languages."

At the end of May the Potsmaster-General, Mr. C. W. Davidson, announced that the radio amateurs in the Australian Capital Territory would from June 1 be permitted to use the prefix VK1 in place of the previous VX2 assignment.

They will retain their call-letter and only the prefix will be changed. ACT amateurs will undoubtedly enjoy the privileges of rare DX stations for quite a time, at least until the DX fraternity sort out the Macuqarie, Heard and Mawson stations from the Canberra gang.

The change will certainly put the ACT on the map in all sorts of outlandish places and more people will learn of the Australian National Capital.

NSW WIA NOTES

LECTURER at the May meeting of the NSW Division of the WIA was Professor Yardley Beers, W2AWH, at present in Sydney with the CSIRO on a Fullbright Scholarship. The subject, "Instrumental Factors Involved in Radio Communication", was a challenge to amateurs to experiment in three specific fields.

The first was work on a receiver to eliminate the paralysing effects of nearby transmitters, the second covered the ideal telephony transmission for amateur stations, and the third, the ideal antenna.

The professor as a physicist explained the theory of solutions to his three suggestions but admitted as an engineer that some of the problems to be experienced would be difficult to surmount.

As with the lecture delivered by W2AWH on Propagation to the VHF Section, this discourse will be recorded as one of the most vital and valuable yet delivered to the division.

The secretarial duties of the NSW Division of the WIA have now been divided. Henry

VHF GROUPS ACTIVE IN ALL ZONES

VK1IJ on Macquarie Island has been hearing mainland station on 50 Mc/s and is now listening and ready to operate on the 56 Mc band; he is anxiously awaiting contacts with VK stations.

The Z calls are now making an impact on the 144 Mc in country areas. Neville Wilde, VK2ZKB, at Blayney, has worked through to Sydney across the Blue Mountains over a 110-mile path.

He runs 40 watts to an 829 screen modulated, a 3 over 3 array and a tunable cascode receiver.

Other Z calls in mid-western NSW include VK2ZBW, Orange, and VK2ZAN, Bathurst.

Some country amateurs were virtually isolated on 144 Mc/s, except for difficult long-distance hauls, now with the Z calls around can readily make contacts on the band.

Dr. Adrian Rofe, VK2HE's, trip to Griffith, South-Western Zone, provided much impetus to 144 Mc band working in the area. With his portable equipment he contacted Hugo Stitt, VK2WH, at Forbes; and Jim Edge, VK2AJO, at Coolamon.

Operation was from Stuart Savage, VK2PL's QTH, who provided the beam array. Adrian lectured to members and enthusiasts of the Griffith Amateur Radio Club, and on his way back he demonstrated his equipment to the Canberra gang.

Old-timer Trevor Evans, VK2NS, of Bathurst, is back on 144 Mc/s with 25 watts of CW and telephony to a three over three array. An excellent signal is being recorded in Sydney and other districts.

The NSW VHF section's Home Station Fox Hunt, conducted on June 10, was an interesting departure from normal competitions. Amateurs operating receiving equipment from their home QTH recorded bearings on a mobile transmitter operating for five-minute periods from five locations around Sydney.

At the conclusion of this activity home stations exchanged bearings as they desired and then plotted the mobile station at each of its five transmitting positions.

Winner of the event will be announced after the committee, VK2ATO, VK2HL, and VK2OA, have examined the locations as plotted by participants.

Russian amateur radio activity has been extended into the VHF and UHF regions, and a number of bands allocated. Unfortunately, they do not coincide with current international allocations. Their bands are as follows· 38 to 40 Mc/s, 190 to 195 Mc/s, 1470 to 1520 Mc/s, and 5650 to 5850 Mc/s.

A maximum power of only 10 watts' input is permitted and to obtain permission to operate in these fields according to reports is rather involved. On the HF's UPOL5 is the callsign of the Soviet Polar expedition.

They operate on 14 Mc/s, using both CW and MCW. US1KAE is their geophysical year Antarctic station and USAF the callsign of the USSR ship Slava, generally in southern waters.

According to the RSGB bulletin in April of this year, Grant Dixon, G2WJ/T, transmitted what is believed to be the first amateur color television from his home QTH to G3CVO/T, some 13 miles away.

Since then a number of successful test transmissions in color have been made between these two stations.

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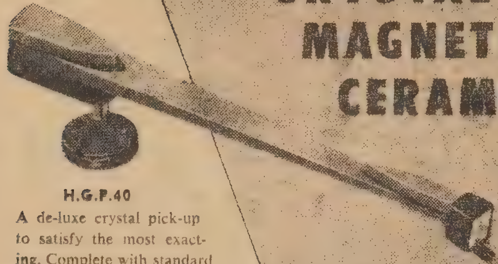

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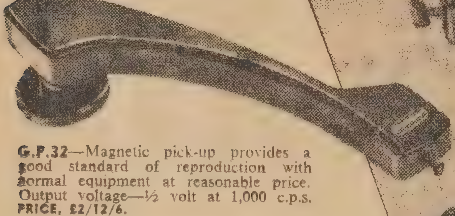

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J, and his wife, will act as cor-
nd filing secretary, while Barry
2ZAG, will operate as minute sec-
meetings.

ıtments for the year 1956-57 in-
lard, VK2ASW, as Federal coun-
ourke, VK2EL, as sub-editor for
; Vince Cahill, VK2VC, as trea-

/K2WI project is well under way
ıday working parties are at the
country members have attended.
dle of May most VK2WI broad-
en conducted from Dural, using
ent or, in the latter period, from
ear.
ommittee, comprising Irwin Stock-
Ric Havyatt, VK2AET; Ed Hulme,
Hart, VK2HO, and Jim Corbin,
esponsible for the general build-
ts and have already decided upon
refinements.
K2AET, has produced the build-
those shown in the monthly

or without suitable implements
t the site, Quarry Rd., Dural, on
n 9 am and 3 pm.
members have already "struck a
transmitting site; they were Alf
, of Lismore, and Rodd Pike,
Coonamble.

BROADCASTS

ıs currently broadcast on short
nterest and value to radio ama-
Voice of America radio amateur
the New Zealand ZKF Morse

sessions, discontinued a few years
presented weekly by Voice of
ıs on 7235, 9500, 11790, 11870,
7380, 21650 and 21730 Kc/s.
at 0445 hours EAST they con-
ırs EAST each Sunday. The ses-
ed again at a more convenient
ırs EAST on the same day.
asts, officially sponsored by the
amateurs to keep in touch with
elopment in amateur affairs in

de presentations are of value to
eurs and those of our number
heck or improve their Morse.
New Zealand army station that
at varying speeds daily on 3436
, using MCW. Commencing at
ST and concluding at 1845 hours
sent in 15-minute sessions, initi-
M and increasing 5 WPM each

orse is the highest speed trans-

Monday in each month a pro-
conducted.
re code practice, the ZKF tape
re excellent copy, the text at
the History of World War I.

" CODE?

of the T code and its current
indicate that it no longer pro-
le contribution to efficient signal
this civilised age most signals are
outs, and it is doubtful whether
per-cent of signal reports for CW
ded these days include a tone
e than T9.
sts in QST that the T numbers
redefined in accordance with cur-
d as a basis for discussion, sug-
s follows:—
tone, no chirp or click.
moderate chirp.
p.
moderate click.
k.
le present.
vould you suggest here?)
vould you suggest here?)
The authorities will surely get

f improvements to the above list
sted and it is an idea that the T
modified for more effective usage.

BAND

withdrawal of permission for UK
to work in the 7100-7300 Kc/s
O has promised that the United
support the exclusive use of the
) Kc/s by amateurs.
the RSGB are requested to report
s any breaches by commercial
full details so that action can

ıre seems to be the most satis-
for amateurs to assist.
as for years advocated a similar
number of amateurs have co-
e reports are required to ensure

meeting of the NSW Division,
/K2AQH, advocated that a moni-
e formed in NSW to fully im-
roposal, also that a co-ordinator
for group working.

From general observations it would appear that the greatest difficulty is experienced in identifying the stations in amateur bands.

The majority of these stations are using high speed Morse and it would take days of spasmodic listening to identify one station, as only rarely do they transmit their callsign at a speed that can be read.

BAND SUB-DIVISION

THE following is the voluntary sub-division of the amateur bands in the HF spectrum in use in Europe and agreed to by all IARU member societies in Region 1.

3500-3600 Kc/s, telegraphy only, 3600-3800 Kc/s, telephony only.

7000-7050 Kc/s, telegraphy only, 7050-7150 Kc/s, telegraphy and telephony.

14000-14125 Kc/s, telegraphy only, 14125-14350 Kc/s, telegraphy and telephony.

21000-21150 Kc/s, telegraphy only, 21150-21450 Kc/s telegraphy and telephony.

28000-28200 Kc/s, telegraphy only, 28200-29700 Kc/s, telegraphy and telephony.

Post-war a gentleman's agreement along very similar lines was in operation here in Australia: during the last year or so it has apparently been forgotten by many amateurs.

NEW BEAM BY "G" HAM

ALTHOUGH no constructional details have been published to date, a general description of the G4ZU "Mini-Beam" which has created a stir in the UK, makes interesting reading.

The beam, an invention of Mr. G. A. Bird, G4ZU, is an ingenius development of the three element rotary used on the 14, 21 and 28 Mc/s bands without switching in the antenna or tuning. G4ZU lectured on the beam at the London meeting of the RSGB.

A precis of this lecture will appear in an early issue of the Society's Bulletin and details are awaited with interest.

The array is being produced commercially by Panda Radio and is covered by patent taken out by G4ZU. It will retail at £18/18/-.

It can be fed with an open line by a normal antenna tuning unit or with a 52 ohm co-axial cable using a three band switched coupling arrangement.

Approximate gains are 4.5 db on 14 Mc/s, 7.5 db on 21 Mc/s and 9.5 db on 28 Mc/s.

The array operates as a two element beam on 14 Mc/s, three element on 21 Mc/s, and five element on 28 Mc/s.

Antennas of similar design have been described in QST but this one appears to be the answer to the requirements of a beam to resonate automatically on three DX bands.

G4ZU has been contacting a number of VK's on both 21 and 14 Mc/s using this array. A number of other G's are using the commercial arrangement "The Globemaster".

With the approach of the sunspot maximum next year DX-ers can look forward to a period of excellent reception.

The Short-Wave Listener's group provides an opportunity for those interested in logging distant stations to meet and discuss the problems associated with the hobby. A cordial invitation to attend the meetings is extended to all interested.

A number of inquiries has been made in recent months by Short Wave Listeners for a call book providing the addresses of amateur radio stations. The only available Call Book is published by the Wireless Institute of Australia and not only covers all addresses but contains much general information on amateur activity.

These Call Books can be purchased from all Divisions of the WIA at a cost of 5/- post free. If any difficulty is experienced in obtaining a copy a request could be made direct to the publishers, the Victorian Division, WIA, COR House, 191 Queen St., Melbourne, CI.

The NSW South West Zone's Annual convention is scheduled to take place this year at Griffith over the Six Hour Day weekend, September 29, 30 and October 1. Each year the venue is changed providing an opportunity for amateurs in all areas to attend. A preliminary meeting was held at Griffith in March. Amateurs from many towns were present and a committee to organise the convention appointed.

It comprises, Zone Officer Jim Edge, VK2AJO, VK2PL, VK2AXD, VK2FS, VK2AVJ, and associate member Laurie Ashton.

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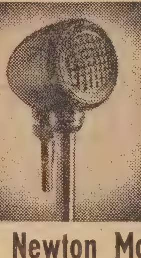

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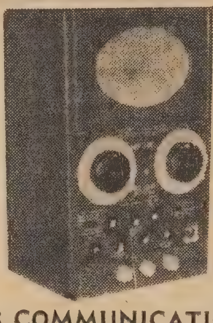

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2AB	£1/0/0	1T4	12/6
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USED EMITAPE
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FIRST CLASS CONDI
7" SPOOLS

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3 1J6. B CLASS OPERA
COMPLETE WITH VAL
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20 Watt 6600 P to P

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WITH EARTH LEAKAGE C

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12V	500V 350MA	8	10	0
12V	1200V 200MA	6	10	0
6V	500V 150MA	6	10	0

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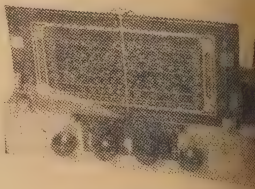

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6 VALVE **£23/15**

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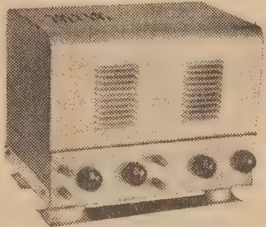

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From £15/17/6

AIN ACCEPTS COMMERCIAL TV

(Continued from Page 31)

he initial fuss was all about.
ay not be free from criti-
are not essentially poorer

BENEFIT

a simplification of a prob-
as many other facets, but I
r comment. I am sure the
l do much to raise the stan-
ne ultimate TV service, to
rogram production which
woefully uneven, and to
evelopment of a better TV

that commercial TV will
y be a great thing for Bri-

achievement in radio and
cent, but it has been a con-
vement. For instance, fun-
C thought tends to divide
ns into a For and Against,
nust remain unbiased, and
too "hot" maybe it is best

n this idea is erroneous and
subjects have many facets,
rganisation can adequately
all. It will be a grand thing
vhen the ether carries as
s possible for people to hear
particularly on controversial
e perpetuation of censored
e biggest danger associated
, and it is always present
V, or both are in the hands
dy, no matter how admir-
its job.

e fair, I have heard this
t forward by responsible
BBC itself.

PPROACH

significant that in the past
e BBC has become more
s handling of topical prob-
neras are probing into pub-
vith a degree of frank com-
ading figures and the man-
hich would have been in-
the past.

must have been difficult
e commercial activity as a
led BBC because so many
rcial executives have been
t. It has not been easy for
e off the patterns in which
rned. But they will, just as
will recover from the first
sharing a pioneer field with
nd the British public learn
hem both.

of British TV has interest-
because it has so many
the Australian scene. The
y can learn a great deal
history now being made

ll into the future, it seems
commercial TV stations
r later appear in Europe.
n up a big field for pro-
nge with Britain. It is
to visualise a European
by commercial operators
lines of the present Euro-
is linked up at odd inter-
or in part. At the mo-
s stations which are com-
ment owned, but this type
of link operation is completely in its infancy and has a vast future.

Commercially it is so vast that the problems facing British operators at the moment are merely incidentals in the growth of a huge world-wide industry.

How good, or bad, is the British standard of 405 lines? Need we be sorry for those who are obliged to continue with a standard using fewer lines than the rest of the world?

NOT TOO BAD

I'd say not. It is true that the definition is lower than one would select to-day, but it isn't as bad as that. On the contrary, after a few days the line structure didn't worry me nearly as much as I expected. I was genuinely surprised that the quality of the best programs was so good.

But I wouldn't go as far as many British people, including enthusiastic engineers, and say that it is not worth while to consider a finer definition system.

As far as the display itself is concerned, the lines can be seen even 10 or 12 feet from a 17-inch screen, and at times you wish they weren't there. Fortunately most British sitting-rooms are not large, and a 17-inch screen is adequate. On a 21-inch screen the lines are so noticeable as to off-set the value of the extra size by demanding that the viewers sit further away. In other words the advantage of the higher definition would be that you could sit closer to a larger screen, if you should want to.

The use of small rooms in the large areas of flat buildings I think explains why many British people find even 14-inch screens satisfactory. With such a receiver, the images are good.

I don't expect therefore that screens larger than 17-inch will supplant this size very readily, although they are for sale.

PROJECTION SETS

As a side comment, there are quite a few screen projection sets in the taverns, mostly made by Decca, but production has now virtually ceased.

What I did find annoying was the high pitched whistle from the line oscillator, which works out at just over 10 Kc, and which is quite appreciable with many receivers. Walking through a TV control room, it becomes quite a trial if your ears are sensitive.

With the 625-line system this frequency is about 15 Kc and will thus annoy considerably fewer people.

Another drawback of the British system is that interference from motor cars, etc., shows up on the screen as splashes of white, whereas with the CCIR standard such interference would be black.

I found that even a small scattering of white spots was a bad thing, but, as I was using an indoor aerial, I saw more than most. The AM sound channel, too, was open to noise, particularly from car ignition.

This isn't the full story, however. Both the AM sound and the narrow video band of 3 Mc allow quite cheap sets to be made, certainly cheaper than if the Australian standards were used. Even so, really good sets aren't as cheap as all that. Top quality 17-inch receivers run to about £85 which is more than £100 in Australian currency. On this basis a 625-line set would be all of £120, but the simpler system does score on cost when you really want to keep it down.

It eases many transmission problems, too. For instance the ordinary twin-pair telephone lines are used quite successfully in many instances for carrying TV signals up to about a mile.

Certainly co-axial cable is preferred, and there is a net-work of it around London for this purpose.

But I don't think the PMG would be very happy if we proposed to send our TV signals along their standard lines!

HOMEBUILDING

No, I don't think we need be too sympathetic with Britishers over their TV, even if our picture is likely to be a better one. Theirs isn't at all bad.

Home building is still quite strong in England, and retail shops selling radio parts are found in all kinds of odd places. There is a good deal of disposals equipment on the shelves, but, as in Australia, most of this has been sorted out and the prices are much higher than they were a few years ago.

Valves, particularly, are no longer available at bargain prices. On the whole they cost very much the same as they do in Australia.

FM tuners account for many sales, but amplifiers, more or less hi-fi, are just as popular if not more so than in Australia. They are considerably cheaper, not only because labor costs are lower but because larger sales help to keep them that way. High quality speakers and pick-ups, too, are very much less costly, as one would expect in the country of origin.

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TIME TO OVERHAUL YOUR CAME

Although summer still seems a long way off now is as good a time as any to give your graphic gear a general "once over" in anticipation of the work ahead of it. Such at will pay dividends in improved pictures and easier working.

By A. J. LOWE, BSc.

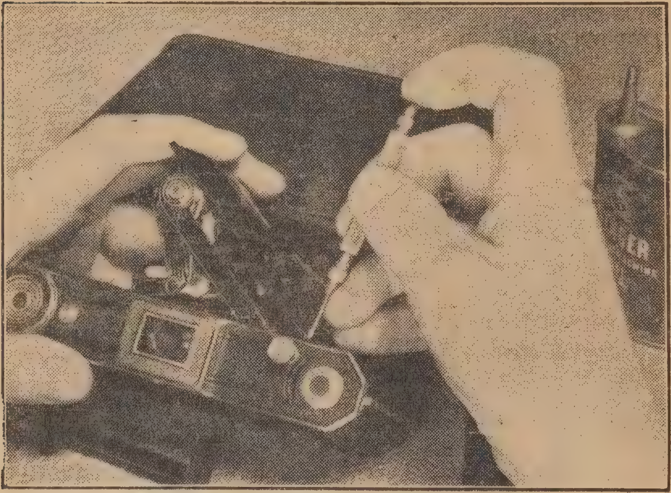

Figure 1: Applying a spot of oil to the camera front hinge. Be sparing; a single drop from the blade of a fine screwdriver should be sufficient. Wipe off all surplus after sufficient has penetrated.

WHEN you get your films back from the chemist, or fish them out of your developing tank, what results do you expect? Five good snaps out of eight exposures? If so, you're probably one of the happy carefree snapshotters (or is it snapshooters?) whose camera stays in a drawer for most months of the year, and sees the light of day only at the start of summer. This article is for YOU.

This year, try to get seven good snaps out of eight exposures, and see how pleased you will be with yourself.

Many of the failures which are experienced can be put down to lack of camera care. Too many people expect their camera to function perfectly without the slightest attention, and it is just expecting too much. If the following suggestions are carried out now — before you start your photo season, you'll stand a much better chance of getting full marks this season.

THE CASE

Let's make a start with the case. Remove the camera and empty out the odd leaves, sand and film box lids, and then give the case a good brushing inside and out, to remove all dirt. Dirt anywhere and everywhere is the worst enemy of good photography, — banish it. Polish the case to make it more waterproof, and check that the shoulder strap is in good condition. Rivets or stitches at the buckle and where the strap attaches to the case, should be examined. It's no fun dropping a camera on the rocks by the sea.

Now the camera. Open it up. You notice how stiff that opening button is? Well a spot of oil on the sliding catch bar will make a world of di the bar is rusted, it should and the rust cleaned off car

A spot of oil on the hing and on the pivots and points ing side struts (see fig. 2, smooth action, and ensure th era does open fully each tin ing focusing consistent. By about this oil. Don't use nor some old sump oil. fine oil, such as sewing m and apply one spot to each tioned. The easiest way to by running a little oil from to the shank of a screwdr touching the end of the scr to the spot required will cient oil to work its way in

REMOVE EXCESS

Now wipe off any excess o operation and clean up the of the camera. Get a NEW brush, and dust out all corners, making sure that any of the bristles which Dust the outside of the b the surround of the lens mount.

Check the shutter operat NOT interfere with it if it is do NOT oil it anywhere. I little below par, take it or thoroughly reputable photog plier for attention. If the fitted with a body shutter rel which is stiff to operate, it examined and a spot of oil ap

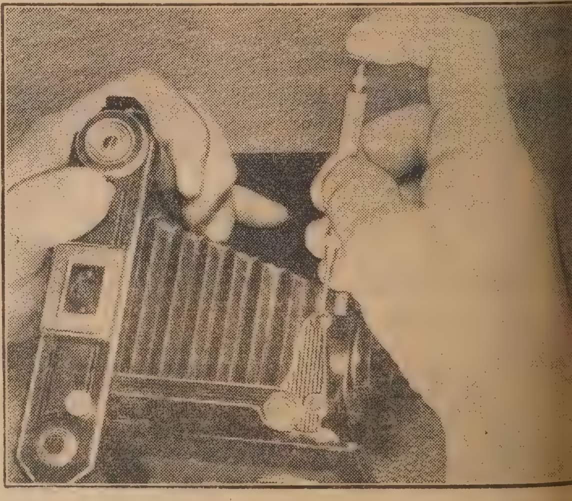

Figure 2: Lubricating the lens panel strut pivots to ensure that the cam fully every time. Failure will affect ability to focus correctly. As before, goes a long way.

A stiff shutter release can or many unsharp pictures, as ire applied to fire the shutter camera at the critical moment. oil may safely be applied to and levers from the button to r, as already warned, do NOT o oil the shutter itself.

e lens. Dust the front of the a clean camel hair brush to ll lint and dust. Wipe the y with a piece of lens cleaning lf it appears to bear finger ey can be removed with a op of carbon tetrachloride, ap- a brush and removed with e.

en up the back of the camera, ve the empty spool. Brush out nd dirt. To remove the dust inside of the bellows, hold the ens pointing upward, and tap e of the bellows (see Fig. 3). ens the dust and dirt, and it of the open back. A vacuum n be used to suck out the dirt. ise a blower to remove dirt, asily blow dirt into the camera, ly damage the lens by hurling at high speed (rather like a ing machine).

he rollers over which the film Fig. 4). If they are stiff or y will certainly scratch your 't forget that it is the precious ide of the film which runs in th these rollers. A spot of oil nove any stiffness, and very cloth will remove any rough re should be taken, if emery sed, to see that the dust pro- s not fall into the camera, and traces are removed after the e.

vorking on the back of the e rear of the lens should be and treated if necessary, as for the front of the lens.

se of unsharp pictures is slack he loaded spool is not fairly veen its pivots, the film in plane becomes slack, and so out of focus. A little careful on of the spool holders, is necessary to ensure that this es not arise. While working ol supports it is advisable to l lubricate if necessary, the echanism.

EAKS

checking job is for light leaks. pin-hole in the bellows can with your results. You can bellows any night as follows: camera back, and insert a rch (with the reflector head The back should then be ith a thick cloth, so that the be manipulated, but so that can get out. Turn off the , and wait for a few minutes eyes are accustomed to the hen examine your bellows for ing, on all four sides. The ld be moved to and fro, and can then get into every fold lows. The camera should be from every angle.

leaks are detected by this ey can be repaired by patch- hin leather stuck into position. ows leaks badly it should be y a camera mechanic.

followed instructions as far as should be well set for seven out of eight snaps per roll. Now if you'd like to get the eighth as well, the best thing you can do is—buy yourself a lens hood—and USE it.

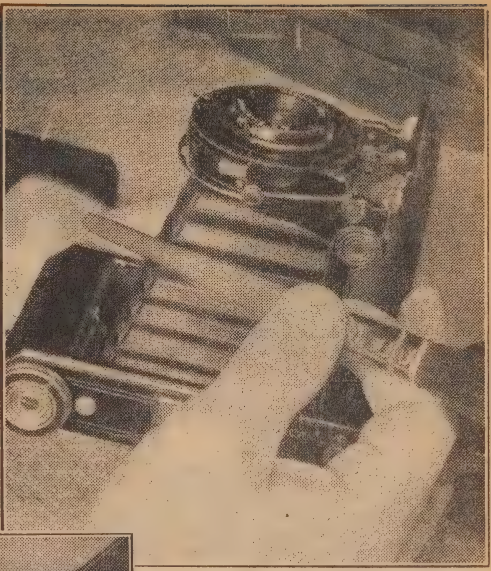

Figure 3: Removing dust from the inside of the bellows. Light taps on the outside with camera vertical and back removed will dislodge most particles. Remainder can be removed with vacuum cleaner

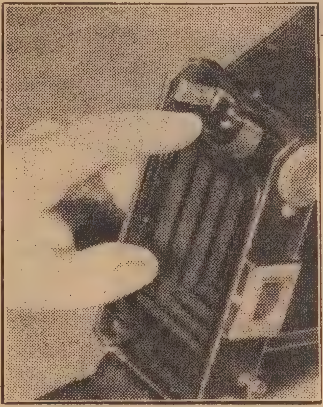

Figure 4: Check the condition of the film rollers both for free movement and smooth surface. Failure of one or both can ruin films by causing severe surface scratches.

TO CLEAN DIRTY DISHES

A 5 pc solution of citric acid allowed to stand in dishes overnight will help to keep them clean. Very dirty dishes may be cleaned with the following solution: water 80oz, potassium bichromate 7oz, and concentrated sulphuric acid 8oz. The latter must be added to the first two very slowly. Either of the above cleaners are likely to attack inferior quality enamelled dishes.

Porcelain tanks and dishes are best cleaned with a 50 pc solution of hydrochloric acid, which can also be used to clean bottles which are internally stained. Hard rubber or vulcanite tanks should be scrubbed out and finally cleaned with a solution of hypochlorite.

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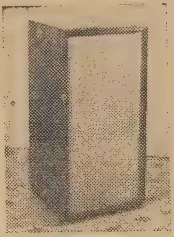

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Weight 45 lbs.

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New model using 100 ohms internal resistance meter, sensitivity 1000 ohms per volt. Voltage readings 0-15, 0-150, 0-300, 0-600, Ohms 0-100,000. This is a pocket size meter, ideal for the electrician, serviceman, amateur, motor mechanic and handyman.

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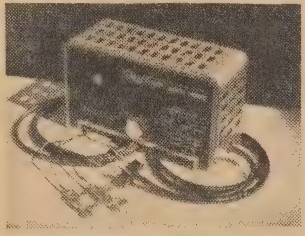

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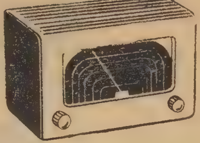
This charger housed in metal case finished in silver grey, hammertone is both attractive and efficient. It connects to 240 volts AC Mains and will charge a 6 volt or 12 volt battery at 2½ amps, has a safety fuse and is guaranteed for 3 months. Brand new and boxed. Ideal for radio and car batteries.

Our Price £7/10/- ea.



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FOR THE LEARNER

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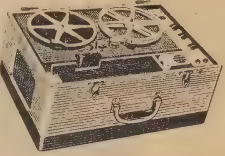
Our Price £5/19/6.



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IGN FOR A PHOTO TIMER

(Continued from Page 85)

ıdition remains while ever vitch is open, meaning that s charged and ready for a ycle.

us consider what happens start switch is closed. As- ıce again, the polarity as now have the screen and 6V6 connected to the posi- al and the cathode to the here is still no bias on the here will be a substantial w in the plate circuit and relay in the conventional As a result the relay will the instant the start switch

ously the 6SL7 will have ltage applied to the plate to the cathode. It also h negative voltage (across between grid and cathode. these conditions will effect- t any electron flow.

POLARITY

sume that the polarity of mer has reversed. The 6V6 ger conduct, but the relay by virtue of the capacitor At the same time the 6SL7 ecome positive and it will osition to conduct—except gh negative grid bias still s.

dition continues, on alter- cles, while ever the voltage d C is high enough to pre- SL7 conducting. However, n C is slowly leaking away and will eventually drop to vhere the 6SL7 commences

s happens there will be an w through R2 producing a ss it and having the polarity making the grid of the ve). But without C2 this ld only be applied during ycles when the 6V6 was ting and would vanish as alternate half-cycle allowed conduct.

OLTAGE

C2 retains this voltage across 6V6 conducting half cycle effectively biasing the 6V6 g its plate current. As the ss C and R drops the cur- the 6V6 also drops, but at h faster rate due to the of both valves. Thus, once commences to conduct, a rapidly reached where the ff and the relay drops out.

there are a number of re- hich improve the perform- circuit, though they are not its explanation. One of provision of set of contacts y which parallel the start hold it closed automatically lay closes. This "locking" ates the need for the opera- he switch in during the en- ycle.

the provision of the 6.3 and potentiometer (shown e grid circuit of the 6SL7. Its purpose is to initiate conduction of this valve earlier than would otherwise be the case, by placing a positive voltage on the grid whenever the plate is positive. (This is achieved by suitable phasing of the two transformer windings.)

If this were not done it would be necessary to wait until the capacitor had discharged to an undesirably low level, involving the near horizontal portion of the curve and too slow a rate of change. It also provides a means of setting the exact point of discharge at which the 6SL7 will commence conduction, and which is a very useful "calibration" adjustment.

The result is a circuit which is extremely accurate, virtually independent of reasonable mains voltage fluctuations, and extremely easy to use. The unit is always ready to "go" at the touch of a button or foot switch and the timing cycle cannot be affected by incorrect operation of this switch.

Once the relay closes no amount of "fiddling" with the start button will affect the time. It can be released immediately or remain pressed, even past the required time, without any effect. The charging cycle is extremely rapid and a selected time may be repeated virtually instantaneously.

This covers the theoretical considerations for the design of our photo-timer. In next month's issue we will describe the practical construction of such a unit.

HI-FI ALL THE RAGE IN LONDON

(Continued from Page 103)

This something new will be the stereophonic disc.

I don't for a moment imagine that the record companies believe a stereophonic (or binaural) disc will ever supplant the present type, or ever be very much more than a specialist's dream.

But they do believe enough people will be interested to make it worth their while to exploit the idea, and no other refinement appears to be in sight at the moment.

Nor do I think that the release of sterophonic tapes is more than an attempt to probe the market, with little at stake and much to gain.

All recording companies in England, and probably elsewhere as well, are making records at present in both straight and binaural form as a matter of course. These can be issued either as tapes or disc as required.

There are three main methods of making stereophonic discs. One of these uses two tracks side by side, after the manner of the Cook records, which have been on sale for some time. This method, I don't think will continue, because it is wasteful of space and requires an awkward pickup.

Another method uses the heterodyne principle, and modulates two signals on a common carrier, each being selected by filters when picked off the disc. But apart from anything else, this method requires pickups with a range of at least 30 Kc to cover the full band.

The third, and I think the most promising method, is to modulate the same groove with both lateral and hill-and-dale cuts. A pickup is used which has two sections, one responding to lateral and one to hill-and-dale movement.

It also has its problems, but every record manufacturer here has made such a record with more or less success. Sugden, of Connoisseur, gave a public demonstration of the method using his own records and equipment at the BSR Exhibition, in London, which was quite a creditable thing, remembering that he was forced to play from acetate discs.

The advantages of the disc as compared with the tape are, in my view, undeniable. The most important point is that a disc presents no new method of handling for the average man. He has been placing discs on turntables all his life. Nothing new is required by the stereophonic disc, apart from twin amplifier and loudspeaker channels.

Only by the production of a foolproof tape cassette, which can be automatically loaded and rewound, would the disc ever be supplanted, even in the specialist field.

I don't wish at this point to discuss the pros and cons of stereophonic reproduction as a whole, although I have heard nothing to greatly change my views. But there seems little doubt that some day soon we are likely to have it in disc form, and that will be the best time to assess how good or otherwise it will be.

The new T.V. Kit No. K.T.V. 2 utilising VCR 97 plus 15 valves and an optical enlarger. Sizes up to 12in.

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ANSWERS TO CORRESPONDENT

J.D. (Minmi) is anxious to build the New Baby Mantel Receiver (February, 1956) and wants to know if we can supply a kit of parts.

A. Sorry, J.D., but, as we have pointed out on previous occasions we do not supply details of components of any kind. For these you must approach our advertisers, and those who specialise in supplying kits to our design will be quite happy to quote you and supply all details regarding availability, &c.

S.J.S. (Box Hill, Vic.) sends a contribution to the Serviceman in the form of an unusual experience with a reflex set.

A. Many thanks, S.J.S., and we will pass your letter on to the Serviceman. In the meantime our only comment is that the phenomena you observed regarding the generator signal passing through the IF (reflex) stage may not be entirely due to the faulty grid circuit. It must be remembered that any audio signal presented to a reflex stage will be handled by it and that many simple oscillators have considerable audio present in the output, quite distinct from the modulation. However, the case is quite an interesting one and certainly unusual.

K.B. (Burwood, Vic.) sends us a suggestion for the Reader Built It page in the form of a simple method of obtaining the EHT for a 5in CRO.

A. Many thanks for your contribution, K.B., and the scheme appears to be quite an ingenious one. We will record it for possible use at a later date.

B.H. (Arncliffe, NSW) has a set which oscillates and he wants to know if we can suggest a possible cause and cure.

A. Without details of the exact nature of the oscillation, the type of set, whether the trouble is of recent origin, what steps have already been tried, &c., it would be difficult for us to offer much help. The most usual cause of oscillation is the failure of one of the paper bypasses, usually from the IF screen. However, there are many other possible causes and it would probably need an examination of the chassis before a positive diagnosis could be made. We suggest you enlist the aid of a reliable serviceman.

H.W. (Cammeray, NSW) writes in support of J.F.N. (Glen Oak, NSW) who raised the question of articles for the beginner on elementary servicing.

A. Many thanks for your comments, H.W., and we will keep your ideas in mind. However, it must be realised that it takes more than a few instructional articles to make a serviceman, most servicemen relying as much as anything on many years of solid experience. One of the purposes of the "Serviceman" articles is to present practical cases to readers from which they may learn something of the most unusual and tricky faults encountered in everyday practice. At the same time we all have to start somewhere and there may be room for a few elementary articles.

J.F.C. (Oakleigh, Vic.) suggests that a series of articles on the early experiments with radio involving the work of Hertz, Marconi, Fleming and their contemporaries would be of considerable assistance to the younger generation in understanding basic principles.

A. Many thanks for the suggestion, J.F.C., and we will keep in mind the possibility of such a series. Unfortunately its preparation would involve considerable time and there is some doubt whether this time would be as well spent as if it were devoted to more current problems. We are glad to learn that you find the magazine so interesting and trust it will continue to provide enjoyment.

J.C.Mc. (Hillston, NSW) has just passed his AOCP exam for the limited licence and suggests we describe some gear for the 144 Mc band to suit beginners like himself.

A. Congratulations, J.C.Mc., and we hope you get a lot of fun out of your activities. Yes, we realise there is room for articles along the lines you suggest and we hope to do something about them in the near future. We regret we cannot undertake to help you in the design of your transmitter but this is beyond the scope of our query service.

K.W. (Forbes, NSW) is inter
sound reproduction and wants
to what exent the weight of th
affects the wear of microgroove

A. There are quite a number
tors affecting the wear of these
most of them being similar
associated with the wear
records. It is true that the
the head is governed by the co
as you suggest, and weight a
pliance both contribute to wear
record and stylus. It is also
comparison of stylus wear can
valid if the various styli are
the same pickup. There a
other factors involved, such
stiffness of the arm, trackin
&c., so that comparison of wei
is not sufficient.

J.A. (Ascot Vale, Vic.) thinks
described enough regenerative
the past few months to justify
ing something larger. He su
superhet with an RF stage and
stage.

A. Seems we can't win, J.A.
frequently taken to task for not
ing enough sets for beginners
is the first time we have been
on the ground of too few la
and too many beginners' sets.
though, we are always pleased
readers' comments, since it hel
decide the type of articles most
It so happens, J.A., that we h
cribed a set along the lines
gest, The Long Range Five in
1954. If your files do not go
far we can let you have a cop
circuit through the query serv

L. McF (Dimboola, Vic.) wants
if he can substitute the VCR13
VCR139A used in the R & H M
Checker.

A.: Unfortunately our inform
this valve is rather limited and
only say that it has a four volt
a separate cathode, employs ele
deflection, and has a ten cont
The two tubes are similar and
be possible to make it work in
cuit with a few small modific

F.R.S. (Bendigo, Vic.) asks
of the R, TV and H which
the description of an AC inver
able for operating an electric

A. An AC inverter was desc
the April, 1951, issue. This use
dard Oak vibrator and therefore
damental frequency was 100 c
thermore, the waveform was by
pure. Certain types of elect
will work well from the inverte
have tried others which refused
at all. For this reason we cann
mend the inverter as suitable f
razors in general.

W.B. (Daylesford, Vic.) woul
see published in the magazine
a geiger counter.

A. We have already done
Information on the subject was
in the March and April, 1954, is
though the magazines are n
available from this office, ci
prints, &c., can be obtained, if
interested, in the usual way th
query service.

G.K.W. (Auburn, NSW) has
radio receiver which works we
normal way but responds wit
click when the refrigerator sw
self on. The effect is accomp
a change in volume and the
haves similarly when the li
switched on and off.

A. The trouble would appe
due to most of the signal ge
your receiver arriving via t
wires rather than through the
larger aerial may effect a cure
is not completely effective, the
would be to instal a filter in se
the power mains. Complete f
can be bought commercially
advertised from time to time.

The Radio, Television and Hobbies Query Service

All queries concerning our designs, to which a POSTAL REPLY is required must be accompanied by a postal note or stamps to the value of TWO SHILLINGS.

For the same fee, we will give advice by mail on radio matters, provided the information can be drawn from general knowledge. UNDER NO CIRCUMSTANCES, however, can we undertake to answer problems involving special research, modification to commercial equipment or the preparation of special circuits.

Whatever the subject matter, we must work on the principle that a letter is too involved if the reply takes more than 10 minutes of our time.

Queries not accompanied by the necessary fee will be answered FREE in the columns of the magazine and presented in such a way as to be of interest to other readers.

To those requiring only circuit reprints, &c., we will supply for TWO SHILLINGS diagrams and parts lists from our files covering up to three constructional projects. Scale blueprints showing the position of all holes and cutouts in standard chassis can be supplied for 5/-. These are available for nearly all our designs but please note they do NOT show wiring details.

Address your letters to The Technical Editor, RADIO, TELEVISION and HOBBIES, Box 2728C, GPO, Sydney.

Note that we do not deal in radio components. Price quotations and details of merchandise must be obtained direct from our advertisers.

tish Army Post Office No 5) etails of transistors and a t which is currently being Japan.

hanks for your letter, I.W.L., enclosed items which were nsiderable interest. We may able to make use of them zine.

irnsdale. Vic.) writes to say ctifier filament pin connec- own in the small amplifier ie December issue are not

ire perfectly right, A.A.E., ected the error too late to n the issue. Such errors rarely as all our diagrams and rechecked a number different technical men but ne does slip through. We ope that you were not convenienced. The circuit page 97 is correct.

aratah, NSW) sends us a cir- 5-valve battery receiver of ruction, for inclusion in the lt It" page.

you very much for the cir- we will file it for possible n that page. One thing we it the circuit is the rather al placing of the oscillator appears between the gang llator coil, not, as is more en coil and earth. While theoretical objection to this does make one more com- ' for RF, and is therefore

water, WA) writes to con- on the standard of our d to express the hope that to grow in popularity. He iscuss any possible methods the performance of the adcast aerial, even allow- e is normally not enough t a resonant aerial.

hanks for the kind remarks, also hope to improve our the future. It is true that much one can do to im- fficiency of the broadcast the physical impossibility resonant. About the best to erect the aerial as high and, if necessary, use a shielded lead to minimise se pickup in the imme- After all, it is signal to which counts most in k signals, since the receiver supply all the sensitivity required. An article on systems appeared in the ue of Radio and Hobbies

onga, NSW) is one of our ers who enjoys the maga- larly the Serviceman's also keen to see a begin- overing basic principles as advanced instruction. He ell of his experience with ve set described in the , issue and how he has minor troubles. Another ars to be the choice of and he is puzzled by the eties. He also wants to make our chassis so com- nts out that older style e stable in spite of larger onger leads.

hanks for your kind re- the magazine and we will that way. We are fully eed for beginners' articles, ave to allocate space and onable proportion to the sts. The Teach Yourself from which you built was one such series in- instructional course for e method you have adopt- regeneration will result nsitivity and is not really . We suggest increasing late by-pass on the 1T4 eneration is easily con- will allow the screen of erate at the correct volt- oice of hookup wire is r of personal preference, ade you like least is one opular. Plastic is norm- as a more satisfactory in- rubber and cotton. The e strands is one of those only experience can overcome. Usual practice is to twist the strands gently and perhaps to tin them lightly before commencing the join. We think a little practice along these lines will help a lot. We do not normally make our chassis unduly small, unless they are for portable equipment, though we do try to avoid unnecessary bulk In most cases there is plenty of room for all components without undue crowding. Small sets are the order of the day and we have to follow this fashion if we are to describe sets which will appeal when compared with the commercial version. While it is true that older sets could tolerate longer leads it must be realised that modern valves and coils have higher orders of gain and are much more critical. For this reason we cannot take as many liberties as with older types.

A.C. (Caulfield, Vic.) forwards the circuit of a battery operated 445 Kc test oscillator for comment. He complains that he is able to hear the oscillator all over the brodcast band with his superhet receiver.

A. It may be that your method of connection is allowing the signal from the test oscillator to get into the IF channel of the receiver directly so that the receiver would respond, regardless of the setting of the tuning capacitor. If this is, in fact, the case we would expect an increased response at about the centre of the broadcast band at the second harmonic of the test oscillator. However, apart from this there are a number of points for query about your circuit and rather than discuss it in detail we would refer you to circuits published in past issues of R. TV & H. They are: the "Switched Tuned Oscillator" (March, '53) and the "Simple Three Band Oscillator" (May, '53). In either case the circuit may be simplified by leaving out the switch and operating the oscillator on the intermediate frequency only. A 455 Kc crystal could be added as you suggest but considering the expense of this item, we feel that it would be out of place in such a simple oscillator.

S.J. (Narrabeen, NSW) forwards a circuit for a two valve superhet receiver using a pair of VR65A or EF50 valves. The first is connected as an autodyne frequency converter and the second as a power detector feeding a speaker. He claims excellent gain for two valves and acceptable power output and distortion figures.

A. It could well be that your circuit will fit into the "Reader Built It" page at some future date and we will keep it in mind for future use.

S.S. (Parramatta, NSW) writes to tell us of his experiments with loop aerials and the adding of another stage to an existing set.

A. Your experiments appear to be quite insteresting, S.S., and you should learn quite a lot from them. It appears you have solved most of the problems involved and this is one of the best ways to learn. Keep up the good work and the best of luck.

BOOKS

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"THE QUEST FOR QUALITY"—a book on hi-fi; well worth the money. Price 8/9.
"TV TIMEBASE CIRCUITS"—one of the hardest to understand features of TV receivers is here fully explained. Price 7/6.
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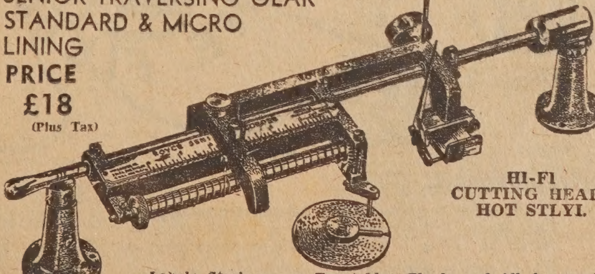

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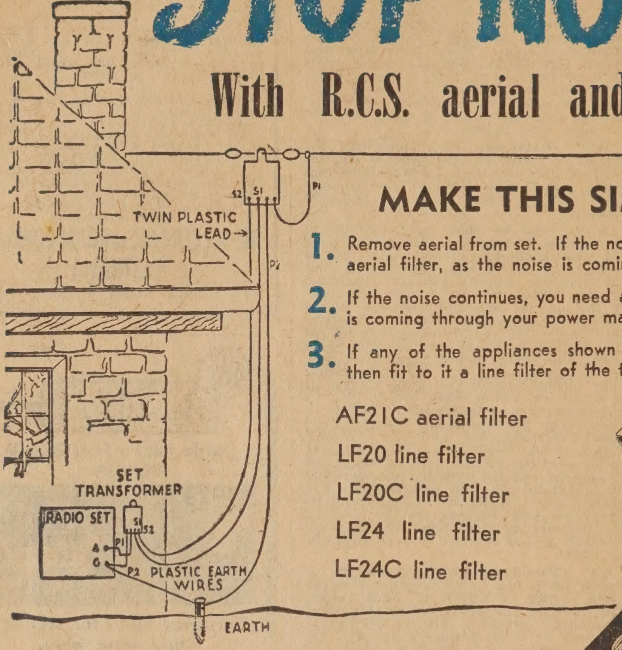
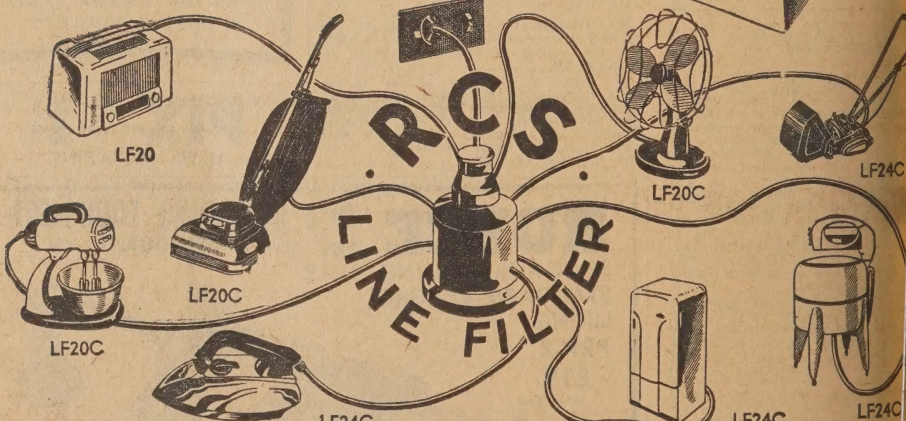

TWIN PLASTIC LEAD
S2
S1
P1
P2
SET TRANSFORMER
RADIO SET
A
G
PLASTIC EARTH WIRES
EARTH

MAKE THIS SIMPLE TEST:—

1. Remove aerial from set. If the noise stops, you need an AF21C aerial filter, as the noise is coming through your aerial.
2. If the noise continues, you need an LF20 line filter as the noise is coming through your power main.
3. If any of the appliances shown below are causing the noise, then fit to it a line filter of the type shown.

AF21C aerial filter
LF20 line filter
LF20C line filter
LF24 line filter
LF24C line filter

CONFINE NOISE WHERE IT STARTS — WITH R.C.S. LINE FILTER


R.C.S.
LINE FILTER
LF20
LF20C
LF24C
LF20C
LF20C
LF24C
LF24C
LF24C

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N.S.W. Bloch & Gerber—Fox & MacGillycuddy—U.R.D.—John Martin — Lawrence & Hansom — Homecrafts — Martin de Launay — Radio Despatch — Cooke Bros. —
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R. C. S. RADIO PTY. LTD.
651 FOREST ROAD,
BEXLEY. PHONE LW 3491

GEIGER–
g Mountaineer

inued from Page 13)

ırds, making use of the slope
im. He duck-dives toward
ouching down as low as pos-
er to get the maximum brak-
om the hill. Takeoff is not,
field, into the wind, but
d in the direction with most
front.
-offs he waxes the plane's
oothing the ski surfaces can
th he needs for take-off by
can be important, when the
t and heavy, as it is during
', the hot south wind which
ıows and causes avalanches.
the reaction time of a pilot
currents you have to know
fly in.
imself perfected the mech-
to the undercarriage of the
allows him a wheel take-
e civil airstrip he is now in
t Sion, and a snow landing

are not only the mercy
h food or transport of
e has fed British and United
ogists in a tunnel bored in
f the Monte Rosa to study
nt of the ice-river; he brings
ner strawberries from the
city markets, and has even
est up to a ski field to say
Sunday before the races

s wriest memories is again of
avalanches, when during a
Dix Valley he lost £2500. It
pay envelopes of the workers
d's highest dam, the Grande
ue to a freeze at 6000ft, his
ened only halfway, letting
ned beans in a corner of the
leaving the pay-packet still

a warmer lower altitude, the
after the ice had melted,
notes drop into a deep
Geiger, as usual, delivered
He went back on foot with
ty and retrieved the money
set to work to perfect the
for opening the bay in all

THE R., TV & H. CROSSWORD No. 27

1		2		3		4	5	6	■	7	8	■
	■		■		■	9			10			11
12	13							■	14			
15			■		■	■	16	17				
18					19	■	20				■	■
	■		■	21						■	■	22
23			24	■	■	■		■	25	26	■	
	■	27		■	28	29		30				
31	32			33			■		■		■	
34							35		36			■
37			■	■		■	38				■	39
	■		■	■		■	40					
■	41						■		■		■	

ACROSS

1. Multiples of the fundamental frequency.
7. Both adverb and conjunction.
9. Reduction in oscillatory amplitude.
12. Another name for an abac.
14. Grecian vase.
15. Latin for two.
16. Random capacitance.
18. Incorporated towns.
20. Head covers.
21. Desert in North Africa.
23. Choose.
25. Symbol for gallium.
27. Upon.
28. Spread with butter.
31. Theatres showing motion films.
34. Unwanted signal.
37. Used on roads.
38. Chinese nursemaid.
40. Colloquialism for a ten pound note.
41. Complete circuit.

DOWN

1. May effect reaction control (2 words).
2. Operating apparatus from a distance.
3. Disorderly revels.
4. Girl's name.
5. Operates valve mechanism.
6. Station Master (abbrev.).
7. Man's Christian name.
8. Merely.
10. Price of carrying.
11. Elastic fluid.
13. French for yes.
17. Used on roads.
19. South Australia (abbrev.).
22. Lose color.
24. Joint in the leg.
26. Goddess.
28. Speaker mounting.
29. To handle.
30. Topic (pl.).
32. Girl's name.
33. Mister (abbrev.).
35. Rodent.
36. Nancy (abbrev.).
39. Prefix meaning three.

Solution and further crossword next month

Last Month's Solution

T	H	E	R	M	I	O	N	I	C	■	■	■
R	■	L	■	O	■	M	■	C	■	T	■	L
I	■	A	■	N	■	E	B	O	N	I	T	E
T	E	S	T	I	N	G	■	N	■	M	■	A
E	■	T	■	T	■	A	N	O	D	E	■	D
T	E	A	P	O	T	■	■	S	■	S	■	I
■	■	N	■	R	■	D	I	C	T	I	O	N
C	Y	C	L	E	■	E	■	O	■	G	■	■
H	■	E	■	D	■	C	O	P	I	N	G	■
A	■	■	T	■	L	I	N	E	■	A	■	E
R	A	D	I	O	■	B	E	■	P	L	A	Y
G	■	■	N	■	■	E	■	■	R	■	■	R
E	A	R	T	H	■	L	I	C	E	N	C	E

MBINATION MOVIE-TV CAMERA

(Continued from Page 15)

till leaving a good deal to
that directors have always
eans whereby they could
scene directly and decide
whether it was up to stand-
t, what changes were neces-

n now looks like being ful-

ıer in which this camera
rather ingenious and differs
that used for TV work.
equirement is not to rob
more light than absolutely
nce an appreciable reduc-
nvolve an increase in studio
ething which could create
lems.
this the system uses what
"time shared light path"
While the film camera is
y the pull-down process
(pulling a new frame of film into place) the light path to the film is interrupted by a shutter. The front surface of the shutter is in the form of an optical mirror and the light path is directed to the image orthicon tube for scanning in the usual way. In this way the TV camera merely uses light which would otherwise be wasted.

ANSWERS TO CORRESPONDENTS

R.J. (Charleville, Q) recently experienced an unusual fault concerning vibrator hash in a country receiver and passes it on to the Serviceman. The trouble was cured by providing a different aerial and R.J. suggests that the use of steel fencing wire for the original aerial may have aggravated the trouble.

A.: We will pass your story on to the serviceman, R.J., and he may comment on it in due course. However, we feel that the magnetic properties of the steel wire would have little effect in a case like this and that the trouble was more likely due to the low efficiency of the first aerial, caused by poor height, insulation, &c. At the frequencies involved, the magnetic characteristics of the wire would be very poor, while the added resistance of steel over copper would not be significant.

WANTED TO BUY, SELL OR EXCHAN

Cost of Classified advertisements in this section is 2/- per line, approximately five words to a line. Closing date for August issue of Radio, Television and Hobbies is Wednesday, July 4.

FOR SALE: Public address amplifier, 6/7 tubes, portable, 2 spkrs., hand mic., 78 player, 240 ac or 6 volts dc. £28. **Ring JX2479 (Sydney).**

FOR SALE: Black and Decker ¼in drill and sanding kit. £18 or nearest offer. **K. Dunham, 185 Audley St., Narrandera, N.S.W.**

FOR SALE: Back Nos. R. & H. Also American Radio News and English Worlds, 2/6 posted. **A. J. Cox, 13 Glover St., Belmont, N.S.W.**

FOR SALE: A.R.C. Test Panel, leatherette case, as new. £40 or offer. **P. Cohen, WF5226, Melbourne,** evenings.

FOR SALE: Model Engineering 1 H.P. Petrol engine castings and print. **Bolton, 72 King St., Sydney.** List 4/-.

FOR SALE: "Super Skyrider" £25. Hifi Radiogram cabinet, 40in x 39in x 17½in. Solid Corestock. Piano finish. £17/10/-. **LW3757. Melbourne.**

FOR SALE: One 5-foot exponential horn £15. **W. A. Walker, 40 Trafalgar Ave., Roseville. JM3209.**

FOR SALE: 20 watt, amplifier, p-p 807's, £20. 5W. amp., suit XTA, p.u., sep. B2T controls, £7/10/-. Philips portable 2 speed (33 and 78) player, in case, £10. G.U. 4 player, HGP 37 T/O XTAL, £10. Valves inc. many for recent R and H ccts., ECC33, ECC83/12 AX7, EL33, 6V4 15 each, 807 6V66, 5U4, 5Y3 10/-, 6L6, 6AQ6, 6BU7, 6AV6, 6AW7, 6BH5, 6N8, 6M5, 6 x 4, 6J6, 66A6, 6BE6, 12/6, OZ4, 1A3, 1A7, 1L6, 1R5, 155, 1T4, 2Ad, 3A4, 3Q4, 3V4, 6A6, 6U7, 6K7, 6SK7, 6K8, X61M, ECH35, EF36, EF39, 6SQ7, 6J7, 6SJ7, 10/-, 6N7, 6C5, 12A6, 12K3, 12SL7, 25L6, 7F7, 5/-, 6V6GT 8/-, 813, £2. Callers evenings and weekends, please **J. Davis, 14 Newry St., Prahran, Melbourne.**

FOR SALE: Eddystone 840 communications receiver. **JJ4956, Sydney.**

FOR SALE: MAGNECORDER Professional Tape Recorder, 7½ and 15 i.p.c. with plus in Equalizers. Outlets 2 ohm and 8 ohm, also 600 balanced line 10 watt amplifier, complete with S.T.C. low impedance microphone and rack mounting panels. £150. **A. G. Hargans, 181 George St., Bathurst, Phone 2820.**

FOR SALE. 94 Radio and Hobbies, 1944-52. Best offer. **D. Bell, 42 Greenhills St., Croydon, N.S.W.**

SELL: Printing, Special Offer:—100 Business or Visit Cards, 30/-; 100 Letterheads, 30/-; 200, £2. Sent anywhere by mail. Do it now! **W. Hiley, 841 George St., Sydney.**

SELL: New 10 watt P.A. system, complete with Xtal mike and 12in speaker. Write **D. J. Holder, 16 Holbrook St., Temora, N.S.W.**

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Hand or desk mounting, counter-balanced base, ivory plastic housing.

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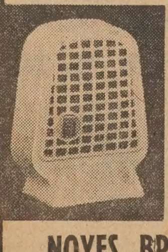

SELL: TR1196A XMTR-RECR, 12 volt, 4 XTAL channels, each way 4-9 Mc. £20 or offer. MN26Y Radio compass recr., unconverted 150-695 Kc. 3-4-7Mc. £25. Want MN2GH or MN26C unconv. pref. 12V. also 12V dynamotor & bandchange motor for MN26, also large DF loop MN24A, good order. **O'Brien, c/o P.O., San Remo, Vic.**

SELL: Special offer. To clear large stocks back issues R. & H., Jan., 1941, to Sept., 1950. Only 2/- per copy, incl. postage, or come and get them at 10/- per year or 10 copies. All other issues 4/- per copy. **T. Weir, 73 Gibson Av., Padstow, N.S.W. UY8056.**

SELL: Copies, back issues, R. & H. Ring **XU2409, Sydney.**

SELL: Radio Controlled Model Aircraft, 5ft span, 6lb weight, complete with xmitter and control box. Uses audio tones. Three valve tuned reed receiver provides rudder, elevator, motor two speed and cut off. 5 C.C. ignition motor. Flight tested and trimmed. £65 or nearest offer. **G. T. Miles, 190 Croydon Rd., Croydon, N.S.W. UA7942.**

SELL: Garrard record changer, £4. Magnavox speaker, 12P1 £2. Both as new **XB1069. Melbourne.**

SELL: A few calibrators complete with therostatic indicator for repairing any make controlled heat and steam irons. New, fully guaranteed, but damaged. To clear at £7. **Central Western Instruments, Orange, N.S.W.**

SELL: Tape recorder magic! Just plug our radio adaptor into your microphone socket and convert your tape recorder into a radio or record your radio programs. No batteries or mains current required, £7. **Central Western Instruments, Orange, N.S.W.**

SELL: 1 only Palec signal generator, Model SG1, in perfect order, only had a few hours' use £50. 1 only University signal tracer, Model ST1 (faulty), £8. **M. Spowart, 96 Melville St., Numurkah.**

SELL: Ribbon microphone. Best offer. **C. D. Johnson, 78 McArthur Rd, East Ivanhoe, Vic.**

SELL: Car Radio, complete with aerial and all accessories, £17/18/-. Also baby mantel 3ct., £17/15/-, and 5 watt amplifier, £11/10/-. Write, **D. J. Holder, 16 Holbrook St., Temora, N.S.W.**

SELL: No. 22 Tranceivers. Complete with 'phones, mikes and aerial. Used by Ham for Mobile Station. Snap sale. Write: **D. J. Holder, 16 Holbrook St., Temora, N.S.W.**

SELL: Goodmans twin cone spkr., polished enclosure, £20. Sat. only, **FY1537.**

SELL: Armstrong A10 amplifier and pre-amplifier. £55, cost £79/10/-. Standard tuner, 3 stage, including stage RF, £10, cost £21, built by Electronic Parts. Both as new, guaranteed. In use 2 months. Purchased Qual and Chapman Tuner. **J. Dunne, Morgo St., Urunga, N.S.W.**

SELL: BC348H converted 240v AC, S and V meters, clock, Xtal band set osc., extra amplif., instruction book, parts B'cast converter, extra good. **J. G. Zaba, Holgate, 1N, N.S.W. Phone 41.**

SELL: "Presto" 16in microgroove standard disc-recording turntable. Completely overhauled and modified, finish in beautiful grey duco and all fittings hard chromed. Unit includes new rubber-mounted, .2 H.P. self-starting synchronous motor with internally balanced armature. Wow flutter and rumble non-existent. £40 or near offer **J. Watson, 2 Redcourt Av., Armadale, Vic. UY5379.**

SELL: "LEAK" pickup, latest 2 head, diamond styles model, £26, also 2—1000 c/s cross-over networks, 15 lhoms, and "THORENS" 3-speed turntable, £6 ea. and £25 respectively. **J. Watson, 2 Redcourt Av., Armadale, Vic. UY5379.**

SELL: "Presto 1c" cutterhead, new condition, excellent response, studio 500 ohms matching impedance, £27. **J. Watson, 2 Redcourt Av., Armadale, Vic. UY5379.**

SELL: Bean and wind remote direction indicators, consists of 2 miniature 5 lead selsyns ex. U.S. equipment. Operates on 6-12v. AC, 35/- pair. Post free. Mail only to **R. Argue, 23 Mount St., Arncliffe, N.S.W.**

SELL: OK1 Mod. Oscillator, complete, £5. **Campbell, 11 Davies St., Merrylands.**

SELL: Speaker Rola 12UX, new, compared with Baker only, £15. **Ring Mr. Fitzpatrick, BO944, ext. 2294.**

SELL: AVO Minor, Mike and Stand,
Tape, Transformers, and Gangs. N
own price. **XL3373.**

SELL: Ham Transmitting and Receivi
Cheap. Ring **XU5517 after 7 p.m.**

WANTED: Good communications
F. Meyer, 505 Hunter St., Newca

WANTED: Buy Ferrotune superhet.
good order. Price. **Mr. E. Watts,**
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WANTED: Australian official radi
manual, Vol. 9. Good price. **V.**
194 Hutt St., Adelaide.

WANTED: Half-dozen plugs, No. N
23 to suit Bendix TA12. Also b
circuits on TA12 and MN 26 Rec. **K.**
Eden, N.S.W.

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W. Peterson, 41 Swift St., Thornbury,

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T. diesel Hopper cooled, 12V auxilia
for starting. Good order. Regulator
meter, £120. **Stephan, Baldry, N.S.W**

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St., Fairfield.

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